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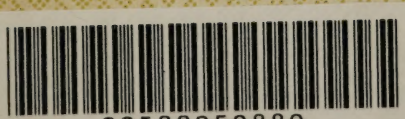

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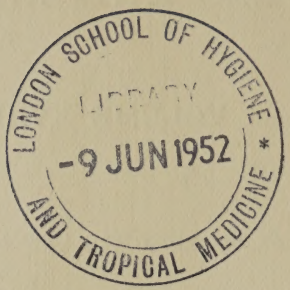

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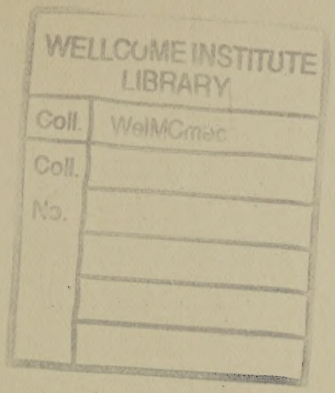

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The papers published in this volume do not necessarily carry with them the endorsement of the Association. The authors alone should be held responsible for all statements made and opinions expressed.

The "List of Members," and the "Sanitary Authorities of the United States, Canada, and Mexico," have been revised to date.

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I.

THE PRESIDENT'S ADDRESS.

By FELIX FORMENTO, A. M., M. D.

New Orleans, La.

Mr. Chairman, Fellow-Members of the American Public Health Association, Ladies and Gentlemen: I feel proud and happy to greet you in this hospitable and beautiful City of Mexico, and to be called upon as your presiding officer to address the 20th meeting of the American Public Health Association, in the presence of such a distinguished audience, composed of the most eminent citizens of our sister republic. What an honor for our Association!

Here we have on the one hand men illustrious in science and in art, in peace and in war; on the other hand, the representatives of the federal and state governments, the high clergy, with, at its head, the Right Reverend Arch-bishop of Mexico. And, as a beam of light and grace enlivening the graver tone of this assembly, have gathered around us the fairest daughters of this land of dreams! All have come to express by their presence, their sympathy for our great humanitarian work. Is not such a spectacle well calculated to inspire us, to encourage us in the prosecution of the labors we are about to undertake?

This meeting of the American Public Health Association in Mexico is an event of too great importance to be passed by without special mention. For the first time in its history, it may be said, our Association has met beyond the boundaries of the United States. The meeting held a few years ago in Toronto, just across our borders, in an English-speaking community, having such affinities of origin, race, customs, and manners, can hardly be considered as held under foreign skies.

This accounts for the unusual interest taken in this reunion by so many savants and sanitarians of both Americas. We are here from every quarter of this great continent, some of us thousands of miles away from our homes, after days and weeks of travel, by land and sea, some in the luxuriant Pullman palace cars, others by the primitive method of mule-back and Indian canoes, over mountains and rivers, across valleys and forests, all undaunted by fear of danger, fatigue, or personal discomfort, by loss of time or money, our hearts beating in unison, our thoughts fixed upon this Mecca, common goal of *You*, devotees to science—soldiers of humanity!

We have come to fraternize with friends, old and new, in this beautiful metropolis, under the united flags of the two great American repub-

lics, with the determination that this meeting will be a grand success in a scientific, as well as in a social, point of view. This day, a new era begins in the political life of our two countries; this day, new and powerful links of mutual affection and esteem are created between two peoples bound together by common destiny, institutions, and aspirations!

This assembly of men devoted to the noblest of all sciences—the promotion of public health (I should say international public health)—is an eloquent proof of the solidarity of our profession, which, ignoring all creeds or politics, and not confined within natural or artificial barriers, embraces within its ranks men of all countries and races, in the same brotherhood, under the banner of progress, enlisted in the search of truth and in the good fight of reason and science against prejudice and ignorance!

Our cause is a noble one, gentlemen. None but the purest motives could inspire the efforts, the workings of an association whose object is to protect the public health, teaching the people those laws of hygiene which not only prolong life but secure health and happiness. We might add that these laws are conducive to morality. By making man sound, robust, healthy, we make him happy and virtuous. It is grand and noble to relieve pain, to cure disease; it is still grander and nobler to prevent sickness and prolong human life!

Preventive medicine is the legitimate boast and conquest of medical science of the latter part of the nineteenth century. Until but a few years ago, private hygiene was alone taught and practised; nowadays, public hygiene, whose object is the welfare of the masses, is absorbing the attention of governments and individuals. It has developed into a new science—Sanitary science or "Public Sanitation."

This leads me to speak of the origin and foundation of this Association. It was, I think, in the year 1872, that the American Public Health Association was first organized. Its promoters were a few far-sighted and public-spirited citizens, who met on a September evening in the parlors of the Ocean House, at Long Branch. The names of those noble men should be here gratefully remembered. To Stephen Smith, Elisha Harris, Rauch, Snow, White, and their worthy associates, our people owe a debt of gratitude which they can never well repay. Many of them have been removed from their sphere of usefulness to a better world. A few of the original founders of our Association are still among our ranks, some with us to-night, and their hearts must rejoice when they see the immense progress this association has made since the day they started it, exerting its beneficial influence over the millions of people, and now ready to unite in one family the sanitarians of America.

Our Association has just entered its twenty-first year. The young and timid child of a few years ago has now attained the period of manhood. I am happy, as its president, to congratulate you, gentlemen, upon its reaching its majority under such auspicious circumstances.

The American Public Health Association aims to awake the interest of the public on sanitary matters; to warn them that the laws of Nature

cannot be violated without detriment to the community, that disease and death are, in the majority of cases, the consequence of the violation of such laws and not a chastisement from above; it is a penalty visited upon ignorance, indifference, and neglect, and not the inexorable decree of a *quid divinum*.

This Association has been the teacher, the tutor of our people, we may say of our governments. Wherever its great health congresses have been held, keen interest has been exerted in hygienic matters, extending even to neighboring cities and states; the people have been led to study their sanitary surroundings and to ameliorate them. Everywhere has local sanitation been improved, causes of disease removed, towns and villages been made clean and healthy, everywhere have the health and physical conditions of the inhabitants been greatly enhanced. In every city where we have met, hundreds of its best citizens have joined the ranks of our Association. As a consequence of this waking-up of our people to the realized necessity of hygienic reforms, numerous auxiliary sanitary associations have been organized throughout the country, and which, acting in accord with the local health authorities, have greatly assisted the latter in the prosecution of their work. Memphis, Nashville, New Orleans, Savannah, Indianapolis, all our cities I may say, have become enthusiastic on the subject of sanitation and have accomplished great and permanent sanitary reforms, which in no other country but ours could have been obtained without the actual interference and powerful financial assistance of the central government. Suffice it to mention here the admirable system of sewerage of Memphis, the work of one of our fellow-members, which has reduced to a very satisfactory figure the once formidable death-rate of that city, twice decimated, in 1878 and 1879, by dreadful epidemics of yellow-fever.

One of the factors conducive to sanitary progress, in great part due to our Association, is the organization of state and municipal boards of health. It was only twenty-three years ago that the first state board in the United States was established in Massachusetts. We now have boards of health and health officers in almost every state, city, town, and village in the country. These organizations have done an immense amount of good; they have awakened the people from their indifference and neglect; they have stimulated them to practical results, they have enlightened rich and poor upon vital questions which were until then entirely unknown. Every citizen to-day fully understands the importance, the necessity, of a pure water-supply, pure milk and wholesome food, removal of nuisances, ventilation, drainage, sewerage, paving of streets, etc. Every one appreciates the benefits of hygiene in all its branches and numerous applications. Great improvements in local sanitation have everywhere been accomplished. Our state boards have done still more for the protection of the public health. Unaided by the national government, left to their own resources, without the coöperation of fellow-states, many of them have undertaken and carried out to complete success sanitary works of truly national importance. I beg to be excused

for mentioning here the remarkable results obtained by the Louisiana State Board of Health, which during the last fourteen years has succeeded in protecting the whole Mississippi valley from invasion of yellow-fever. Thanks to our incessant vigilance, to our perpetual state of defense, thanks to our admirable system of quarantine, yellow-fever has been excluded from our shores, while at the same time our commercial relations with Central and South America have been greatly extended, and we hope will take greater development in the future. But a local system of maritime sanitation, however perfect it may be, will not suffice by itself to bring about these much desired commercial facilities. It will be our duty to study, to suggest such sanitary measures and quarantine reforms as are required in those ports of the gulf and of the Antilles where yellow-fever is endemic, and which have most direct commercial relations with our American ports; to study the proper construction of steamers plying between those ports, their equipment, furniture, crew, etc., the proper methods of disinfecting them at the point of departure, during the voyage, and on their arrival.

It is our paramount duty as *sanitarians* to indicate and cause to be enforced such measures as will secure the public health. Subsidiarily, as *citizens* we should foster the development of commerce and business relations between our respective countries as the main source of wealth and prosperity of a people.

The American Public Health Association has the support, the backing, of the whole medical profession of the United States. It will soon secure the endorsement of the distinguished and enlightened profession of this country. Thanks to its influence on public opinion and on the press, it has been able to obtain the passage of many excellent laws in favor of public hygiene and sanitation.

Every one of our meetings, held annually in a different city, has served not only to establish more intimate relations between our fellow-members, but also between the people of different sections of the country. Everywhere we have found something of interest to us. Here particularly, many new and instructive object lessons will be imparted to us. We will be able to compare the old and new civilization of this extraordinary country; the remnants of the mysterious civilization of the Aztecs and the wonderful achievements of progressive modern Mexico!

In matters which concern us most directly, we will find ample opportunities for study and investigation. We will visit with surprise and admiration your great engineering works for the drainage of this remarkable valley; these works first undertaken three centuries ago and which have just been brought to a successful termination. We will find in your admirable code of sanitary laws many excellent provisions to adopt.

Nothing, gentlemen, is more apt to bring men together than common interest. A common cause unites us; our object is the same. We are working, not in the interests of one particular section or state, but for the amelioration, the welfare, of the whole country. This desire, this ambition, has extended beyond our political frontiers. We recognize that

in science, in public hygiene, the different nations of a whole continent are as much our fellow-citizens as those living under our flag and institutions.

In this age of rapid railway communications we are all equally interested in preventing the introduction of foreign pestilence, in removing permanent, endemic causes of disease, whether they exist within our own borders or across the frontier. We are engaged in a common fight. We can only win by concert of action, by a well elaborated plan of battle. To that end we have come to you, and we hope, with your assistance, to see the influence of this our common Association extend to the fartherest limits of the American continent.

The United States, Canada, and Mexico are already working in harmony towards securing this great object of a mutual protection, by improved sanitation and a progressive system of quarantine which will *protect* without unnecessary restrictions upon commerce and the hardships of the past. We want Cuba and the Central and South American states to join our Sanitary Protective Union. We will then be able to formulate some systematic practical plan, by which all unnecessary restrictions will be removed, and to adopt a system of international notification, and report of all contagious and infectious disease, a system which now exists among the different states of the American Union. By this means, confidence will be established, sensational rumors prevented, panics avoided, and the barbarous shot-gun quarantine abolished. By concert of action and coöperation, our boards of health will be enabled to stamp out contagion without creating a disturbance in the whole country.

This meeting, I predict, will establish perfect confidence and harmony between the sanitary authorities here represented. There is no telling, gentlemen, to what results may lead this coöperation, this better knowledge of men and things, this common understanding, this moral obligation freely and unreservedly subscribed to by men of honor, to help and protect each other, to discard all measures not sanctioned by science. Statesmen and diplomats have invented as bonds of union between nations, Dreibunds and Zollvereins, reciprocity and the like. What are those measures in comparison to the Sanitary Union we propose? They disappear in their insignificance. The former, based upon political or economical considerations alone, are ephemeral: the latter, born of a great humanitarian thought, should be immortal.

This is the age of sanitary engineering. Thanks to it, whole sections of country, formerly made uninhabitable by malaria, have been redeemed to habitation and agriculture; cities once foci of disease have been remodelled and made clean and healthy; trades and industries once considered as fatal to man have become innocuous.

The sanitary engineer goes hand in hand with the modern sanitarian. Their united efforts have accomplished wonders; by their joint action, thousands of lives have been saved and millions of dollars added to the public wealth. See what has been done in the case of London, where,

with its four millions of inhabitants, and the unfavorable conditions arising from such an agglomeration of people, the death-rate has been gradually reduced, in a comparatively short time, from forty per thousand per annum to sixteen per thousand. Consider the changes in the sanitary conditions of Marseilles, Toulon, Rome, Naples, and other cities, once hot-beds of disease. Since the last cholera epidemic which decimated Naples in 1883, the Italian government, in spite of its financial troubles, voted sixty millions of francs for the sanitary improvement of that city. Numerous examples of the kind are to be found both in Europe and America. It is sufficient to recall to mind the gigantic sanitary work of New York, Chicago, and this very City of Mexico, whether it be to obtain an abundant supply of pure water, or to secure a proper system of drainage and sewerage.

Never was there a more propitious time to agitate this great question of public sanitation. Governments and individuals begin to fully realize that sanitary improvement is a good investment; that hundreds or thousands spent in that direction will bring back millions and millions, to say nothing of the added value of increased population and diminished death-rate. It pays to enforce sanitation.

Will it be said that the united efforts of our people will fail to accomplish that which single-handed cities and communities, far less wealthy and prosperous than ours, have accomplished? What Italy has done in Naples and Rome, are our governments unable to do?

The great vital problem for us, gentlemen, is yellow-fever. Are we not justified in hoping that our combined efforts will find out its true epidemic causes and the proper means to wipe it out? The Mexican Gulf ports, the Antilles, the Atlantic coast of South America, all reputed habitats of yellow-fever, call to-day for energetic action. We must smother the scourge in its very cradle.

We are in an era of progress. A near future will realize our hopes. The stamping-out of yellow-fever will be the triumph of modern sanitary engineering.

To attain such a goal, which would create a new epoch for our respective countries, what are the proper measures and means? Without discounting the future, I would respectfully suggest, as a preliminary step, the appointment by the Association of a permanent committee "On the origin and development of yellow-fever and the proper means to wipe it out at its birth." This committee to be composed of sanitarians and engineers, from the different countries represented in this Association, invoking, if necessary, the assistance of our governments.

Let such a committee set to work deliberately, make an annual report of its labors, and in a few years I am confident we will have accomplished great results.

Let us now review the principal events and improvements that have taken place in public hygiene since our last meeting. The facts and figures here given are mainly taken from the remarkable article on "Hygiene and Epidemiology," in the Annual of the Universal Medical

Sciences, issue of 1892, by our worthy Vice-President, Walter Wyman, A. M., M. D., Surgeon-General, United States Marine Hospital Service.

The most notable sanitary event of the year 1891 was the seventh International Congress of Hygiene and Demography, held in London, August 10 to 17, 1891, two months before our last reunion. Sir Joseph Fayrer, president of the section on preventative medicine, referred in his address to the wonderful improvements in the public health of England due to sanitary work, showing that in two hundred years the death-rate had diminished from 80 per thousand to 17.85 per thousand, per annum.

"In some parts of England," he says, "where the main object is the recovery or maintenance of health, the death-rate is down to 9 per thousand, while in others where the main object is manufacture and money-making, it is as high as 30 per thousand. The decline in the general death-rate has been from 22 per thousand in 1866–'70, to 17 per thousand in 1890. This is no doubt due to the enforcement of sanitary measures prescribed by the 'Public Health' and other sanitary acts. A still further decrease will follow a more general and energetic enforcement of these acts, with a corresponding improvement in the material and social welfare of the masses."

To show the relation of filth upon the public health, Luigi Manfredi has made elaborate investigations on the composition of the dust of the streets of Naples, giving the number of microbes of all kinds per one gram of dust. Remarkable differences in the proportion of microorganisms exist in the dust from the different quarters of the city. In the cleanest streets the number of microbes was ten millions (10,000,000) per gram, while in some of the dirtiest streets that number was raised to five billions per gram. In every case the unhealthiness of the street or quarter was in direct proportion to the number of microbes in the dust.

The question of water-supply for towns and cities continues to be the absorbing topic among sanitarians and engineers. Every one recognizes the relation existing between the water-supply of a city and the prevalence or absence of typhoid fever, dysentery, and cholera. Water is the habitual vehiculum of the pathogenic germs producing those diseases. These will disappear wherever and whenever a supply of pure and untainted water is obtained. Filtration, for water-works, is now recognized as the best method of purification of water from rivers and streams.

A proper system of drainage and sewerage is not less desirable than a pure water-supply. Everywhere a greatly reduced death-rate has followed the introduction of such a system. We expect great results in my native city from the system now being carried out.

On the subject of alimentation we will say that the necessity of meat inspection, as well as that of a fixed standard to determine the quality of milk, and the prohibition from the market of tuberculous milk and meat, are now recognized by all sanitarians, and sanitary laws to that effect are being gradually adopted and enforced in every country.

The question as to whether the addition to food of antiseptics as pre-

servative agents constitutes an adulteration, has been repeatedly discussed among sanitarians and manufacturers. Salicylic acid was first used as a preservative, especially in beer. In a law-suit, by some French brewers against German beer introduced in France, and which almost invariably contained salicylic acid, the Paris court of appeals decided that that acid was to be regarded as an adulterant and to the prejudice of the purchaser. A commission of the Academie de Medecine, appointed to inquire into the action of salicylic acid in food, reported that in many instances it had produced serious effects, and that small but continued doses were likely to result in grave gastric and hepatic disturbances. All addition of salicylic acid was prohibited by the French, Italian, Austrian, Spanish, and Dutch governments. Since the general prohibition of the use of salicylic acid, other substances have been used in its place, such as bi-sulphites, benzoic and boracic acids, benzoates and borates. The boracic acid and borates are generally considered to be the mildest and most harmless of antiseptics. We are of opinion, however, that the use of all antiseptics, whether as preservative agents or for the purpose of "re-greening" of vegetables, such as is practised so extensively in France with sulphate of copper, should be strictly prohibited by law.

VACCINATION.

It seems strange after all that has been said and written in favor of vaccination, and the overwhelming proofs of its efficacy everywhere, that we should be obliged to notice at the end of this nineteenth century, that this practice still finds some opposition in certain classes of the people, and even among physicians. We are greatly surprised to see Dr. Le Fort in a recent discussion at the Academie de Medecine on the results of obligatory vaccination in England and Prussia, endeavoring to prove that the decrease of the mortality by small-pox in these countries is due more to isolation and the erection of special hospitals than to obligatory vaccination, which, he adds, would never have been voted for in a French chamber. In refutation of such dangerous doctrines we will simply call your attention to a table to be found in Wyman's article on Hygiene, Annual of 1892, showing the annual death-rate from small-pox per one hundred thousand inhabitants in Prussia and Holland, *before* and *after* the enactment of the obligatory vaccination laws; and on the other hand, the results noticed in Austria, where no compulsory vaccination exists.

QUARANTINE.

The subject of quarantine was extensively discussed at the Seventh International Congress of Hygiene and Demography. Sir Joseph Fayrer expressed the English opinion in regard to it when he said "*that* we can exterminate zymotic disease altogether is not to be expected, but there cannot be a doubt that we may diminish its incidence, and though we may never be able to reach the '*fons et origo mali*,' yet we can

make the soil upon which its seed is sown so inhospitable as to render it sterile."

Surgeon-General J. M. Cunningham said that sea-quarantine had done no good; that quarantine was a tyranny, obstructing commerce and interfering with personal liberty, etc. While we admire the remarkable progress made in England in local sanitation, and are among the first to recognize the extraordinary results achieved by it—some of which have been mentioned in this paper—we cannot help considering such doctrines as fraught with danger and entirely at variance with the results obtained in other countries. The resistance of England to quarantine can only be ascribed to its insular position, its great distance from the source of yellow-fever and cholera, and its favorable climatic conditions. In fact, outside of England, the English people make no objection to quarantine; we notice that the countries in the Mediterranean basin which are the most severe in the matter of quarantine are the English possessions of Gibraltar, Malta, and Cyprus. We know that in Canada strict quarantine restrictions are enforced under the superintendence of my distinguished predecessor, Dr. Montizambert. In the United States, the general process of disinfection, besides thorough cleansing, discharging of ballast, pumping out of bilge-water, scrubbing of wood-work, etc., consists of fumigation with sulphur dioxide; the use of bi-chloride of mercury and steam-heat, with a reasonable period of observation.

Disinfecting apparatus, by means of steam under pressure, should be of more general use in local sanitation. Every hospital should be supplied with one, and in all large towns there should exist, as in many cities of Europe, some establishments where bedding and infected clothing could be properly disinfected. That the general laundry has been the means of spreading infection in many cases, there can be no doubt.

INFLUENZA.

At the close of the year 1891, influenza was raging violently in most countries of Europe. It prevailed in epidemic form in Russia, Austria, England, France, and Germany. In Berlin alone not less than forty thousand cases of influenza were reported during a period of four weeks. About the same time it was quite prevalent in almost every country of the world. In Japan it prevailed extensively, fifty thousand cases being reported among the Japanese in Yokohama alone. Since epidemic influenza first appeared in the United States, in March, 1891, it gradually spread until every city and town in the whole country became affected with the disease. It generally prevailed for a period of about six weeks, indirectly causing everywhere a very high death-rate, interfering in many cases with the municipal public service. In some cities it seemed to assume new forms and to constitute, so to speak, a new disease, or rather to give rise to new pathological lessons. Those of the so called grip-lung were the most striking. In this form rapid infiltration or

solidification of a whole lung sometimes took place in the space of twenty-four hours, not from hepatisation or pleuritic effusion, but from what seemed to be solidification of effused liquid material in the substance of the lungs. This condition, often noticed in my own practice, when not rapidly fatal, lasted months and months, no remedy proving of any avail apparently, the patient owing his recovery to *vis medicatrix naturae*.

As far as I know, the causal micro-organism has not yet been discovered. The disease has once more disappeared as mysteriously as it first appeared.

CHOLERA.

This dreadful scourge, which only a few weeks ago threatened the continent of Europe, has now ceased to occupy the public mind, except in the city of Hamburg. America has once more been spared the horrors of a chorera epidemic. You will remember that in 1884, when it reigned epidemically in Spain, Italy, and France, we escaped it on this side of the ocean. Studying the course of the disease, we find it followed the same route as it did in 1831 and 1847. Brought from Persia to Bakhum, the eastern termius of the trans-Caucasian railroad, it soon spread in every direction, on the western shore of the Caspian sea, reaching Petrovock, Astrakhan, and advancing into the interior to Tifflis, Samora, en route towards the Black sea and Central Russia; from Russia it was carried to Hamburg, Antwerp, and Havre, by Jewish emigrants booked for the United States. In Hamburg, where all the conditions favorable to its propagation existed, the epidemic soon assumed immense proportions, causing several hundred deaths per day; whilst in other cities in better sanitary conditions, notably Berlin and Paris, where it appeared, it did not spread and did but little harm.

The facts relating to the recent importation of cholera in New York city, by infected Hamburg vessels, through a defective system of quarantine, and the stamping-out, by isolation and other strict sanitary measures, of the few cases which had there developed, are too fresh in our mind to require much dwelling upon. New York had been found shamefully unprepared. At one time the danger was threatening indeed; there was a momentary panic all over the country. But soon recovering, the people awoke to energetic action; measures were at once taken to place cities and towns in proper sanitary condition, and to prevent by sea and land quarantines the introduction of the pestilential disease. So far we have escaped the danger. Our future safety is at the price of our continual vigilance.

Let us here remark that the cholera inoculation of Pasteur and Haffkine has proved quite successful in the case of guinea-pigs, which have been rendered cholera-proof by it. If the heroic experiment recently accomplished by the New York Herald correspondent can prove anything (it being an only case), such a method promises equal results with human beings.

IMMUNITY.

We cannot close this review without mentioning a few of the latest and most curious investigations on the subject of immunity.

Recent researches of bacteriologists have demonstrated that immunity against certain communicable diseases can be acquired by inoculation of the blood-serum of an animal naturally immune to that disease; for instance, the blood-serum of a goat, which possesses a natural immunity against anthrax, if injected to a susceptible animal, will protect the latter against the disease; in this case the most violent injections will give no results. In like manner the blood-serum of an animal rendered artificially immune will, when injected into another animal, likewise act as a protective vaccine.

The pathogenic action of all infectious bacteria seems to be due to toxic products, or toxines, secreted, elaborated during the active development of the bacteria cells.

Bacteriologists are now everywhere absorbed in researches and studies, destined to find out the proper method of isolating these toxic products. Extraordinary results have lately been obtained.

Prof. Tizzoni and Dr. Cattani, a lady physician of the University of Bologna, discovered some time ago a protective vaccine against tetanus. After many experiments they succeeded in finding in the blood of an animal refractory to tetanus, a particular substance, the "Tetanus Antitoxine," which they isolated and cultivated. This substance injected into animals invariably protected them against the most virulent inoculations of tetanus.

But still more extraordinary are the results achieved. Further experiments proved that this antitoxine is not only a preventive but a curative agent of tetanus, not only in animals but in man. Cases of actual recoveries by antitoxine injections in advanced stages of the disease have been observed by Tizzoni, Cattani, and Schwartz of Padua, and other successful results under the same treatment have been since reported.

This success with tetanus suggested the idea of generalizing the method and applying it to rabies. Previous experiments made by Tizzoni and Schwartz had shown that the blood-serum of an animal, rendered immune by Pasteur's vaccination, naturalized the virus of rabies to the point of rendering its inoculation perfectly inert. New experiments were made on animals actually affected with rabies, and it was demonstrated that injections of the blood-serum of an animal so rendered immune, not only prevented the development of rabies, but cured the disease already in existence. Some cases of recovery are reported in which the injections were practised as late as forty-eight hours after the disease had developed. Drs. Tizzoni and Cattani have very recently communicated to the Regia Accademia dei Lincei the result of their latest experiments. They have succeeded, after numerous complicated researches, in extracting from the medulla of a rabid animal, a substance, antitoxine, apparently free of all virulence, and which,

injected into animals affected with rabies, is reported to have actually cured the disease. We already possessed Pasteur's preventive inoculation; if time and experience should confirm the Italian physicians' observations, Tizzoni's method will become the curative treatment of a disease which up to the present time had baffled all the resources of science. So far the Bologna savants have operated on animals only. Let us hope their method of treatment will prove equally successful with man, giving as good results as the analogous treatment of tetanus by antitoxine injections.

While on the subject of preventive inoculation, we deem it but just to recall to mind the experiments of Freire, Carmona, and others on the prevention of yellow-fever by inoculation of attenuated virus. Their methods have not received the unqualified sanction of science. The existence of the micrococcus xanthogenicus has been denied by many; still, we must admit that their researches are in line with the principles laid down by the immortal Pasteur and in consonance with the latest discoveries of bacteriologists. By analogy, we should not belittle the results they may lead to. At any rate, it is proper and just to recognize their scientific efforts and encourage them. Failure itself is honorable, when engaged in such a cause.

Thorough investigations of this important subject should be entrusted to unprejudiced and disinterested parties, experienced in the diagnosis and treatment of yellow-fever. They should be versed in chemistry, and in the use of the microscope and other instruments of the latest perfection. These duties might well be confided to the yellow-fever commission proposed by us. It would investigate the subject of yellow-fever inoculation, as well as all points relative to the origin, cause, and propagation and prophylaxis of the disease.

Up to this time, the researches of bacteriologists have been of more benefit to preventive medicine than to the rapeutics. Only in a very limited measure has the knowledge of a specific cause of disease been conducive to a specific treatment. The latest discoveries of bacteriologists, among whom our distinguished fellow-member, Col. George M. Sternberg, Surgeon, United States Army, seems to indicate a new departure in the treatment of infectious diseases. Although, as sanitarians, we are more directly interested in preventive than curative medicine, yet the subjects are so closely allied that progress in one is a step forward in the other. In this connection we deem it appropriate to reproduce the following extract from the masterly address "on general medicine," read at the Detroit Meeting of the American Medical Association, by our esteemed friend, Dr. A. L. Gihon, Medical Director, United States Navy.

"Erhlich's experiments with pathogenic toxalbumins, Sewall's, showing that immunity from poisoning by rattle-snake venom may be produced by small doses of its toxic agent, and other facts, give strong support to the view that all infectious diseases are due to the action of substances resembling the toxalbumins already discovered, and that acquired immunity from any of them is due to the formation of antitoxines in the blood of the

immuned animal. Sternberg suggests the possibility that in these diseases the toxalbumin which gives them their specific character is a product of the living cells of the body of the infected individual, and says the inference is justifiable that the blood and tissue-juices of any individual who has recently suffered an attack of small-pox or scarlet-fever, contains an antitoxine which would neutralize the active poison in the circulation of another person immediately after infection. Dr. Sternberg holds the experiment warrantable to ascertain whether a small quantity of blood drawn from the veins of the protected person would suffice to arrest or modify the course of these diseases. The transfusion of a moderate amount of such blood might be curative or confer immunity in advance of infection, and possibly an antitoxine may be obtained from the blood of vaccinated calves, which would have a curative action on small-pox. Dr. Sternberg has himself demonstrated, by recent experiments with the blood of vaccinated calves, that there is something in this blood which does neutralize the specific virulence of vaccine-virus, both bovine and humanized."

These experiments are still in their infancy; it is impossible to foresee the results they may lead to. A new light seems to be dawning on the horizon of preventive medicine as well as that of general therapeutics. Has science reached the point of coercing nature to yield its secrets? Will the medicine of the future consist in opposing curative antitoxines to toxic microbes? But without dwelling much further on this subject, it suffices to indicate, that since the remarkable discoveries of Pasteur and his followers, new horizons have been opened to science, justifying the hope that in the course of time wonderful practical results will be attained in all branches of medicine.

In my opening remarks were mentioned the causes which created particular interest in the present reunion; a spirit of justice induces me to mention here the two main factors which have secured its success.

Shortly after our last meeting in Kansas City, our worthy secretary undertook, in the interest of our Association, a long and fatiguing journey to the remotest regions of this immense country, to Cuba and Central America. Its principal object was to excite the interest of the people and of the different governments in sanitary matters and to obtain their participation in this meeting. To that effect, Dr. Irving A. Watson was commissioned as "Health Ambassador" to Mexico, Cuba, and Central America. For the first time, perhaps, was such a mission confided to any one. No ambassador of kings and monarchs has ever received a more flattering and hearty welcome—an honor rendered to the personal merit of the man as well as to the representative of this great international organization. His mission was a complete success.

The chairman of the local committee of arrangements plays a no less important part in the happy results of our meetings. No better selection could have been made than that of our eminent and distinguished chairman, Dr. Eduardo Licéaga. To the high official position he occupies, to the legitimate influence he commands, to his scientific attainments and social standing in this community, the success of the congress is mainly due.

This double debt, to our secretary and to our chairman of the local committee of arrangements, is cordially acknowledged and I take pleasure in tendering them the thanks of the assembly and the assurance of my personal gratitude.

Let us congratulate ourselves, gentlemen, upon our acceptance of the pressing invitation of the Mexican government to hold this health congress in Mexico. This intelligent transfer of the scene of our debates, far beyond our boundaries, to the capital of our friends and neighbors, is the first step to the scientific unification of the whole American continent. This is the first real International Health congress held on this side of the Atlantic. As such, its duty is to unravel the problem of yellow-fever, which is the only obstacle to the much desired commercial, social, and intellectual intercourse between our respective countries and nations. Yellow-fever is the curse and drawback of America's southern climes. If this meeting could successfully devise the means of stamping it out forever from all parts of the continent, it would richly deserve the blessings of future generations!

In another point of view, this meeting deserves our reciprocal congratulations. We only needed to meet in conference, and immediately a bond of friendship was sealed, not merely between scientists but between the two nations.

In addition, what an opportunity, never to be forgotten, of seeing, of admiring Mexico in all her glory! To witness the prosperity of this land of the Montezumas under its progressive republican form of government, its modern resources, to contemplate its bold railways and viaducts, suspended in mid-air, in their vertiginous ascent and descent of gigantic mountains, its beautiful valleys, torrents, and streams, its thriving towns and cities, rendered rich by local industries, its mines and its forests, its palaces, cathedrals, schools, and museums, the whole brought in relief by the vestiges of its immortal past, a double civilization in striking contrast!

Should we leave unmentioned its delightful climate, its blue sky, its wonderful fruits and beautiful flowers?

But above all stand the noted courtesy, the exquisite refinement of its inhabitants, who have made us at home and filled our hearts with everlasting gratitude!

This day will be inscribed in gold letters in the annals of the Association, and I here express the sentiment of the whole assemblage, when I exclaim from the bottom of my heart, *Viva México!*

II.

ADDRESS.

By EDUARDO LICÉAGA, M. D.,

Chairman Local Committee of Arrangements, President of the Superior Board of Health, and Professor of Operations in the National School of Medicine.

Mexico.

Mr. President of the Association, Mr. Mayor, Ladies and Gentlemen: The executive committee of the American Association of Public Health having honored me with the appointment of president of the local committee of arrangements, encharged by the statutes with the preparations for its annual meeting in this capital, my first and most agreeable duty is to give public expression to my gratitude for so unmerited a distinction.

Using the powers which the appointment carried with it, I organized a local committee of arrangements, consisting of the members of the board of health, and Drs. Ramón Icaza and Manuel Gutiérrez, both of whom were already members of the Association, and of other prominent gentlemen, such for instance as the minister of communications, whose official standing and personal worth I judged, and judged, as the event has proven, rightly, would aid powerfully in furthering the ends of the committee.

Each member was empowered to appoint as many assistants as he saw fit for the discharge of the duties allotted to him.

One of my first cares was to inform the president of the republic and the minister of the interior of the decision of the Association to hold its meeting this year in the City of Mexico, and of the distinguished honor that had been conferred on me. It is most gratifying to me to state that the chief magistrate of the republic entered enthusiastically into the plan, promising me his best assistance in the despatch of our preparatory labors. He was pleased, moreover, to apply to the legislature for an appropriation to defray the expenses most urgently demanded, and to send a letter to governors of states, urging them to appoint delegates from among the members of the local boards of health to attend the meetings of the Association. It is, therefore, another of my duties on this occasion to pay a public tribute of acknowledgment to the illustrious chief of the Mexican executive for his powerful aid to the committee which I have the honor to represent.

It is also a duty to return my cordial thanks to the minister of the interior, who, both in his official and private capacities, has aided with

his advice and personal resources in organizing some of the pleasure-trips which we shall offer to our esteemed visitors.

My thanks are likewise due to the city council, to the drainage commission, and to the representatives of the contractors who have so kindly given the members of the Association an opportunity of inspecting this important hygienic work, to the Jockey club, to the railway companies for considerable reductions in fares, and to all the gentlemen who consented to act on the committees.

On inquiry of the secretary of the Association, as to whether the local committee was entitled to send out invitations on its own account, an affirmative decision was obtained, and, in consequence, invitations were addressed, through the consuls of Mexico, to the republics of Central and South America, to the Island of Cuba, and the other West Indies, to the governors of the States of the Mexican Union, and to all the physicians and sanitary engineers in the republic.

The Argentine Republic alone has forwarded, through our diplomatic representative there, a complete set of published treatises on hygiene. Venezuela and Guatemala promised to send contributions, which, however, have not been received. The governors of the states replied that their delegates would contribute essays, some of which have not as yet come to hand. Two hundred and fifty physicians of the capital city and the interior, and a few sanitary engineers, signified their intention of being present at this meeting.

Mr. Mayor, Honorable Representative of the City of Mexico: I have the honor of introducing to you the members of the American Public Health Association, our distinguished colleagues of the United States and of the Dominion of Canada, as well as our own fellow-citizens. All of them have left their business and their homes, bearing hither their store of wisdom and experience wherewith to further the great work which the Association has in view, and conferring on this city the distinction of being chosen as the scene of their annual labors.

In the name of the Superior Board of Health, which invited you to hold your meeting here and feels honored in your acceptance of that invitation, I extend a welcome to the Association, and express the hope, in which all my colleagues unite with me, that the brief stay of its members in our midst may be in every way agreeable.

Gentlemen, it is to me a source of the purest satisfaction to see you come from distant lands, animated by the noble resolve to shed on all sides the light of science and to help the nations of the earth to a better understanding of the blessings of hygiene. You come like apostles of the gospel of science to preach on the time-honored Hippocratic text, "*Mens sana in corpore sano*," to show that to make men healthy is to put them on the right road to being good,[1] to remind mankind that nature furnishes us with light and air in lavish abundance,[2] that pure

[1] Dr. Formento—Dr. Septien.
[2] Dr. Geo. Homan.

water and good food preserve health and lengthen life,[1] that the clothes which cover us must not incommode us, and that the dwellings in which we seek protection from the extremes of heat and cold must be so disposed, and the ground on which they are erected so drained, as not to become a source of harm to their inmates.[2]

The inevitable refuse of men and animals is a source of many diseases when it is allowed to accumulate and putrefy near us, and you show us how to dispose of it without injury either to ourselves or our neighbors.[3]

The factories which cater to our wants, which are the life and soul of commerce, and constitute so important a factor of national wealth, discharge into rivers and drains, or scatter far and wide in the atmosphere, substances injurious to health or offensive to our senses. The health of factory operatives may be impaired by emanations from the material to be worked up, by the nature of the substance to be handled, by an insufficient supply of air, by excessive hours of toil. The nature of the labor may be such as to imperil life itself, as in underground mining or the handling of explosives.

It would seem hopeless to attempt to combat the numberless evils that beset the life of the operative—a class which constitutes the bulk of the population of every large city,—and yet hygiene is always on the watch, marking every peril, and telling us through you how to obviate them and how to prevent capital from over-riding the claims of humanity.

But what is to be said of the diseases that from time to time afflict and decimate the human race? Is not history present to attest the small progress that has been made in combatting the worst of those diseases, when they appear in the epidemic form? Have we not before our eyes the sad picture of cholera killing half of those on whom it lays hold? True. But, on the other hand, we see Bacteriology patiently at work, discovering the germ which produces those diseases, the conditions under which it lives, thrives, and propagates, as well as those which are antagonistic to it and of which we must avail ourselves in combatting it. No, gentlemen, we are not entirely impotent in the presence of disease, for some we can master, others mitigate, and yet others abridge. But, above all, it is given to us to ward them off, to prevent their development and propagation. For this the natural history of disease has been slowly built up by the labors of physicians in every age and every clime,—a goodly foundation, which science has bequeathed to us and on which the structure of modern progress has been reared. Observation is ever patiently at work, noting symptoms, watching the progress of diseases, marking their termination, the proportion in which they proved fatal, the climates and places most favorable to their development, the influence of seasons, of age, sex, condition, and employment.

Look at the history of the great epidemics that have swept the earth, with death and mourning in their wake, that daunt the weak and para-

[1] Dr. Kedzie.
[2] Dr. Kedzie—Dr. Corlett.
[3] Dr. Chapin—Dr. Hoyt.

lyze the energies of the timid, and you will see, in the midst of the panic-stricken throng, the man of science, calm and self-possessed, studying the characters of the scourge, inquiring whence it came, how it spread, what strength it draws from air and soil, how nations and governments must act to protect themselves from future visitations.

This is what hygienists have always done: witness the measures laid down in the Mosaic law at the dawn of ages.

History still preserves record of the stringent and efficacious laws which in the Middle Ages almost stamped out leprosy; barbarous measures, it is true, but proving beyond all manner of doubt that, though to cure diseases is hard, man has it in his power to avoid them.

It appalls us even now to read of the measures taken against the plague. Yet the plague has been blotted out from the face of the earth. How terrible the means employed to accomplish that end! Isolation carried to the extent of sequestration, the loss of civil rights, enforced celibacy, the severance of family ties—in a word, the sacrifice of the individual to the good of the community!

Our milder customs, our ampler resources, enable us to carry onward the work of our forefathers in a different form and justify us in hoping that our descendants will acknowledge their indebtedness to us for their deliverance from cholera, from yellow-fever, from diphtheria, and from typhus.

The immortal Jenner taught us how to ward off the small-pox, a disease which, with the lapse of time and the growth of enlightenment, will die out from among mankind.

Pasteur, the glory of our times, has taught us, too, how to render innocuous the bites of mad animals.

Pasteur, pointing to the atmosphere as the habitat of pathogenic germs, and Lister, that benefactor of humanity, warding off those germs which poison and render fatal the wound where they find a lodgment, have taught our modern savants to look to science for the means of forecasting and baffling disease.

Bacteriology is the hope of hygiene, both now and for the future.[1] It will discover germs as yet unknown, will continue to study the natural history of those that are known, and when it has found out their mode of generation, their habitat, their nourishment, the conditions under which they thrive, and, above all, those under which they die off, then it will be in a position to place more effective weapons in the hands of hygiene.

When the day comes on which we shall know the conditions which render the life of each class of microbes difficult or impossible, and the natural or chemical agents capable of destroying them, then all that hygiene will have to do will be to produce those conditions or to apply those agents.

But I shall be told all this is a mere dream, an unattainable ideal. I answer, No. The territory we have won is an earnest of still wider con-

[1] Kellogg.

quests. Already much has been made clear as to the cholera bacillus. It is known to penetrate into the human organism through the alimentary canal, to live and propagate in the juices of the stomach and intestines, when they are in an unhealthy condition, but not when they are sound. It has been proved that the germ is contained in the discharges of patients, that those discharges contaminate water and soil, that water, in particular, is a favorable medium for its cultivation and propagation, and that a damp soil is also propitious to its development. Hygiene avails itself of all these facts, as it has done of late to check the ravages of the epidemic in Europe. Clinical science teaches us that the germ of tuberculosis cannot thrive, except precariously, at considerable altitudes,[1] that abundant air and light are the best preservatives against the Koch bacillus, and that darkness, insufficient air, bad food, and an undermined constitution are the agents which give it potency. We have learned from science that the microbe finds its way into the human body through the organs of respiration or the organs of digestion in milk and in food, through wounds or abrasures,[2] which either maintain it locally or transmit it to the lympathic glands. Equipped with this knowledge, hygiene busies itself in curing the sick, in isolating patients, in erecting *sanatoria*, in taking measures to stop the spread of the disease. No; the feasibility of arresting disease is no longer an irrealizable ideal.

The comma bacillus, the Koch bacillus or bacillus of consumption, the bacillus of typhus, and the diphtherial poison part with their virulence at temperatures exceeding 75° C. and, without doubt, are totally Pasteurized when subjected to temperatures of 100° C.

The destructive action of acids on the germs of these diseases is a fact completely established by the bacteriology and clinics.

The action of solutions of bi-chloride of mercury and sulphate of copper on the comma-shaped bacillus is also well ascertained, as is also that of phenic acid on the Eberth microbe and that of a concentrated solution of the same on the Klebs microbe.

By a careful application of these natural and chemical agents, the destruction of germs is assured and the spread of bacterial diseases avoided.

If we are to form an accurate estimate of the province of antiseptics in the extinction of infectious diseases we must survey their marvellous results in the department of surgery. By dint of sagacious and patient observation, Lister arrived at his theory of antiseptical surgery. In the paper read by him before the British Medical Association, at Dublin, on August 9th, 1867, he enunciates his theory as follows: "But inasmuch as the experiments of Pasteur have shown that the air does not derive its deleterious properties from oxygen or any other gaseous elements, but from certain inferior organisms which it holds in suspense, it occurs to

[1] Le Plateau Central du Mexique (La Mesa Central de Mèxico) considèrè comme station sanitaire pour les phthisiques. Memoire lue par le Docteur E. Licéaga au Congrés International de Berlin, Aôut, 1890. Berlin.

[2] Dr. Corlett.

me that it would be possible to prevent the putrefaction of wounds by excluding air from them and treating them with substances destructive to the particles which float about in the atmosphere."

Such was the beginning of antiseptical surgery, which, in the space of twenty-five years, and in the hands of the most eminent surgeons of the civilized world, has succeeded in completely revolutionizing the whole practice of surgery, and in diminishing the seriousness of wounds, and the number of deaths arising from them, to an extent that would appear incredible were it not for the testimony of statistical returns recognized as unimpeachable alike by foes and friends.

By excluding from wounds the pathogenic germs which once poisoned them, we are able to avoid suppuration, septicæmia, pyæmia, hospital gangrene, erysipelas, etc. The antiseptic method as applied to obstetrics has put an end to the disastrous effects once wrought by disease germs in women during the period of labor, and which at one time caused such ravages in maternity hospitals that the idea of closing those establishments was seriously entertained.

The aseptic and antiseptic methods are now complete masters of the field of surgery, but to accomplish this result what difficulties had they not to contend with! The opposition which every innovation arouses had to be overcome. Men ridiculed the rules laid down by the founder of the method requiring the use of the silk protective, the folding of the bandage saturated with phenic acid a given number of times, the application of mackintosh, the enveloping of the whole with cotton-wool, etc., without remembering the object underlying these minute precautions, viz., the exclusion of disease germs from the wound; without reflecting that the first steps were being taken in a new science, that the details were not identical with the method.

When the world had assimilated the idea, the skill of practised surgeons was applied to the simplification of the details, while the investigations of thousands of scientific men are ever carrying the method nearer and nearer to perfection.

The results have more than compensated the labor spent in obtaining them.

The task now to be accomplished is to apply the practice of antiseptics to other transmissible diseases. If the germs which produce those diseases are similar to those which poison wounds, they can be destroyed before they attack men or animals.

Let us apply the theory of Lister to disinfection. Cholera is a transmissible disease; the discharges of patients contain the comma-shaped bacillus; apparel tainted with those discharges harbors it and may transmit it to our persons and thence to our food. But the domestic water supply is the great vehicle of infection, owing to its constant use for drinking and in cookery. The soil furnishes a congenial home to the germ. But, on the other hand, the only way by which it can penetrate into our organism is through the digestive organs. Let these be in good condition, let the juices of the stomach be in their normal state of acidity,

and we are in possession of the real antiseptic agent furnished by nature for our protection. But when the stomach or intestines are unsound, their secretions form a congenial element for the microbe. Then it is that it multiplies and produces the disease.

It thus appears that in the healthy condition of the body the gastro-intestinal juices are the primary antiseptic agent furnished us. But we are enabled, too, to destroy the germs before they reach our organisms, just as Lister destroyed the germs capable of finding a lodgment in wounds. As soon as discharges are produced, we can treat them with the solution of sulphate of copper, of phenic acid, or bi-chloride of mercury, in suitable proportions. If the discharges have tainted the soil, we can counteract their ill effects with the disinfectants named already, or with lime-water or chloride of lime. If mattresses, bed-clothes, underwear, hangings, etc., have been soiled, let us not neglect to subject them to the action of the steam disinfecter where the combined heat and pressure will exterminate the bacteria. If our hands have been polluted, let us be sure to wash them with a solution of phenic acid before carrying them to our lips. If there is any possibility of our water-supply having been contaminated, we must not fail to boil it, for ebullition deprives the bacillus of all its virus. The same precaution must be taken with milk and all other susceptible liquids.

As the soil, under favoring conditions of heat and moisture, is known to harbor the germ, we must take care, in times of epidemic, to avoid low-growing plants, as well as fruits and everything else likely to have been in contact with the ground.

Such are the counsels contained in every publication on the subject, and in reality they are nothing more than principles of aseptics and antiseptics applied to the case of a bacterial disease. If the practice of antiseptics is of the highest value in protecting wounds from noxious germs, why should it not prove of equal efficacy against the organisms producing contagious diseases? Clinical operations have proved it in practice, and bacteriology has demonstrated it scientifically in the laboratory. Our duty as hygienists is to proclaim the supreme utility of disinfection, to call into use against each microbe the antiseptic that will most surely destroy it, to inspire our colleagues with our own unshaken faith, and above all to preach the creed contained in the following words: Just as, in practising laparotomy, in order to enjoy the security that septic peritonitis shall not supervene and snatch away our patient, it behooves us not only to know that aseptics and antiseptics are useful but to have undergone a long course of practice in their use and acquired an absolute mastery over all the details of the operation, so, in the case of disinfection, we must become familiar with our weapons and learn how to wield them with the same precision as in surgery has been attained by such men as Lister, Billroth, Volkmann, Bergmann, and their compeers, who are indebted to the system of disinfection for their most signal triumphs in the performance of difficult surgical operations.

But there is one difference between surgery and hygiene, as considered

in relation to disinfection, which must not be passed over, for in sanitary science—a science of pure application—it is of the highest importance to understand thoroughly the practical side of the problem. The difference in question is, that while in surgery the application of the disinfective method is performed directly by men who have spent the better part of their lives in studying the theory and practice of operations, sanitary disinfection has to be carried out vicariously, by men who, having had no scientific training, do not adjust their work to scientific rules. Such, for instance, are the men entrusted with the disinfection of dwellings, furniture, hangings, upholstery, etc., of ships or infected portions of ships.

But these men are but the necessary instruments, and the man of science must guide their hands while engaged in the process of disinfection, must furnish them with minute instructions, must put them through repeated lessons until entire familiarity is attained.

On the other hand, the disinfection of mattresses, bed-clothes, underwear, and the articles technically known as susceptible, is performed by means of the steam disinfecter, an apparatus which does its work with entire perfection.

The principle, that it is easier to prevent disease than cure it, is older than medicine. The sacred books of India and the book of Genesis are the earliest witnesses to the existence of that principle. Hygiene has always formed an integral part of medical science, and the Hippocratic works are full of it. But sanitary science, as at present understood, is quite modern, and its progress has been so rapid that the degree of perfection attained in the sanitation of cities constitutes to-day the great standard whereby the civilization of nations may be estimated. The eagerness of scientific men to extend their knowledge in this science is evinced by the fact that eight International Health Congresses have already been held. To-night's assemblage is itself a signal proof of the tendency of modern hygienists to widen their field of observations.

If there be any one who still persists in believing that it is not given to man to diminish the number of diseases, to prolong human life, and to ameliorate the condition of the race, he would surely be disabused of his error if he saw this small army of the most eminent authorities in sanitary science, from every state of the American Union and the Dominion of Canada, who, leaving their homes and their affairs, have travelled thousands of miles and assembled in this spot with the purpose of contributing by their teachings to the improvement of the health of nations. It is absurd to suppose that a mere abstraction, a poetical ideal, could thus, within a few brief days, gather together the representatives of the two most eminently practical nations on earth. Such a gathering could not have taken place, were it not known that the death-rate of the older cities of England has diminished from eighty per thousand to seventeen per thousand, as a result of sanitation, and that the new cities of the United States have succeeded in banishing the small-pox, by means of compulsory vaccination, and malarial fevers by improved systems of

drainage and a pure water-supply; had it not been seen of late how the cholera has been stayed with a firm hand at the very gates of the populous commercial city of New York.

And what have our visitors come to do in our midst? They have come to impart to us their own faith, to instruct us in their method of working, to spread new ideas, to concert with us a mutual plan of defense against the propagation of such diseases as arise among us, to see what means nature employs to enable us to breathe at this immense altitude, to observe how we build our dwellings in a climate in which artificial heat is not required, to admire the purity of our atmosphere, the transparency of our light, the radiance of our sun, to examine the modifications produced by the meteorological conditions of this altitude, within the tropics, on the mode of existence of animated beings.

As for ourselves, we welcome them with open arms. We purpose to show them our hospitals, far inferior, alas, to the splendid monuments which they have reared in the name of charity, to explain in what manner the government extends protection to foundlings, to ailing children, to orphans, how it imparts to them a knowledge of the mechanical arts, how it reclaims the erring, and how many of these institutes are organized on a military footing. We shall conduct our guests through the establishments where education is furnished to the teachers, male and female, whose duty it will be to spread the benefits of elementary knowledge, through our preparatory professional school, through our schools of medicine, jurisprudence, music, and fine arts, through our national medical institute, not on account of the intrinsic excellence of these establishments, nor because we imagine that they can endure comparison with the superb foundations which private munificence has reared in your own countries, but because we believe that, perchance, you may take an interest in beholding these evidences of the moral and intellectual development of this people, so torn by political convulsions, which attack nations in their infancy and adolescence just as disease attacks and exhausts the physical and mental constitution of man in boyhood and early youth.

We shall show you, too, the works recently undertaken to secure an improved water-supply. At your last meeting one of our sanitary engineers explained to you the project for a new sewerage system for the city, to supersede the present very defective one, and now you are about to see the provisional works undertaken for the purpose of improving the flow of the sewers until such time as the new scheme can be carried out in its entirety. We shall enable you to view, and as hygienists you will be interested in viewing, one of the most gigantic works ever undertaken for the sanitation of any city—the drainage of the Valley of Mexico.[1] Finally, we shall conduct you through the suburbs of the city and spread before your eyes a view of this broad valley from the historical hill of Chapultepec.

[1] The drainage board has prepared an account of this important undertaking, from its inception down to the present time, to be distributed among the delegates on the occasion of the visit to the works.

And as for you, esteemed fellow-countrymen, who have also left home and business and come hither from afar to recount your experience of the dreaded yellow-fever, your speeches will inform us whether that scourge is produced spontaneously among you or whether it is imported; and if so, in what way, and what steps you have taken to liberate the coasts from its ravages. Others among you will tell us the places where malaria prevails, and what has been done for their sanitation; the regions in which tuberculosis is unknown, or its ravages are less violent than on our coasts; the towns which are free from diphtheria, those others in which it rages; the measures which you recommend to prevent the spread of typhus, the method by which your cities are supplied with water, and all other matters of interest to hygienists.

Little has been done as yet towards the sanitation of our cities, but this is a truth which we need not be ashamed to confess, for we are a young people, desirous of understanding thoroughly the evils under which we labor before seeking a remedy. Our governments have given us good sanitary laws, and it remains for us to devote our intelligence, our energy, and our zeal to the service of our countrymen and the fulfilment of those laws; thus contributing to the noble ends of the American Association of Public Health, which has accomplished such splendid results in the United States and Canada, and which will, we trust, accomplish the same results here.

Gentlemen, receive the thanks which I offer you in the name of my country, for having selected this city as the scene of your annual meeting.

Gentlemen, I bid you welcome.

III.

ADDRESS OF WELCOME.

By SR. LIC. JUAN BRIBIESCA.

Mr. Governor, Respected Members of the American Public Health Association—Ladies and Gentlemen: A painful illness prevents the president of the municipal council from enjoying the honor and pleasure of saluting the distinguished members of the American Public Health Association, who are now our guests, in the name of Mexico. Specially commissioned by that functionary, I now come to address you, and salute you in the name of our country, and bid you welcome to its capital. In complying with this duty, which I deem to be an honorable distinction, I feel two different sentiments arise in my spirit,—the one, an intimate satisfaction that I feel in addressing this solemn meeting, and the other, the profound conviction that I can in no way fitly substitute for the learned Don Manuel M. Contreras, one of our most distinguished mathematicians and learned engineers. But duty obliges me, and I have to forget as far as possible, the superior merits of the person for whom I substitute, in order to greet the American Public Health Association in the name of the people of the capital of the United States of Mexico.

This Association has now existed for twenty years, during which time it has given practical results for the advancement of science and the well-being of man. It approved certain resolutions on the subject of quarantine, which, being accepted and placed in practice by the government of the neighboring republic, have resulted in freeing some of its cities from the contagion of yellow-fever. The Association was founded in 1872, in the United States of the North, and it is truly and entirely American, because it comprehends all the countries of this New World, the home of Liberty, that four centuries ago rose up from the seas and was born to the life of civilization and Christianity, called thereto by the distinguished genius of Christopher Columbus.

The objects of this Association are of the very greatest importance to humanity, as they tend to the preservation of health and the consequent lengthening of human life. This alone is sufficient reason why the members of this Association should possess the affectionate sympathies of all men, and merit the most perfect protection on the part of all governments.

Science is cosmopolitan because it is the patrimony of the student and of the intelligent man in all nations of the earth, because it always

descends from the speculative to the practical level for the well-being of man,—thus increasing our enjoyments or diminishing our pains, at times bringing to our knowledge another law of the universe, and at others turning itself into a telegraph or a railroad that brings business men nearer to each other, while at other times it turns itself into a telescope that carries the earth nearer to the worlds that people the firmament.

Science is a blessing, and is the light of truth that illumines the intelligence and raises the level of human nature, proving that the spirit of man is really made in the image or semblance of God, creator of the universe.

Our beloved Mexico is especially interested in the labors of the Association, because it is at present traversing an important period of its social life. The drainage works of the valley are now being executed and rapidly advancing, and it is hoped that their completion will result in improved health and beauty of scenery. The government has taken steps towards the sanitation of the houses, under regulations which were first discussed by the supreme board of health. Last year Mr. Gayol, delegate from Mexico to the Association, had the honor to read in Kansas City the scheme for the drainage and sanitation of our capital, a scheme that, in combination with the works now being executed, will render Mexico one of the most beautiful and healthiest cities in the world. Under these circumstances, the labors of this Congress will naturally give the best results for this city, to the great advantage of its inhabitants in particular, and to the advantage of all the Mexicans who love their capital as well as their country.

But there is another reason why this Association should merit our special consideration and respect; there is another reason much greater than those I have spoken of, and that is the honor which it confers on Mexico in selecting it as the place in which to celebrate its sessions for this year. The meeting of this Congress is really a civilizing agent. It is a high honor to Mexico, or for any other country, when scientific, learned, and philanthropic men abandon their ordinary work and private business to discuss, in a foreign land, questions of general scientific and humanitarian interest for the good of men.

Respected members of the American Public Health Association, the people of Mexico, knowing and appreciating this honor, and considering virtue and learning as the greatest attributes of man, cordially salute you, and welcome you to this capital, which has been the theatre of so many and such important historical events, and the centre to which our hearts have always turned. Your visit to Mexico is symbolical of union and of the development of mutual sympathies, and forms a new tie between our countries. Your labors are blessed, because they are an evidence of progress and of civilization.

IV.

THE GROUND OF SAFETY.

By R. C. KEDZIE, M. D.,

Lansing, Mich.

It is a vigorous and suggestive expression when we speak of our mother earth. Sprung from the dust, we live upon her bosom and draw our supplies from her ample stores; and when "life's fitful fever" has burned itself out, our ashes drift back to their original source. Let us then humbly accept the fact that as regards our physical existence we are of the earth, earthy, and that we shall never free ourselves from these fetters of clay till mortal shall put on immortality.

Though we tread the soil beneath our feet, yet in an important sense it is for us the physical basis of life. While water is the type of treacherous instability, the solid earth represents confidence and safety; to have our feet on solid ground is to be secure. In times of flood and shipwreck our confidence in terra firma is fully brought out. Yet even this implicit trust may be shaken. It is said that no form of danger begets such overwhelming terror in man and beast as the earthquake, when the very ground of our security becomes a source of peril. We tremble before the thunderbolt and the tornado, we turn pale under the withering wings of pestilence, but the soul dissolves in terror with the heaving throb of the earthquake. Thus, under uncommon circumstances, the ground of safety has conditions and is to be accepted with limitations.

The noblest physical fact in nature is life, for it is the gift of God. If life is noble, then the physical conditions of life cannot be ignoble. To turn his thoughts for a time to the physical conditions of life is wise in man, because continuance in life is conditioned upon and limited by its physical surroundings. The ordinary conditions which modify and even limit the common life of the human race, demand serious consideration. Common life is a tame and uneventful theme for discussion. The uncommon life of the great, of heroes and statesmen, of generals and admirals who scourge the earth and vex the sea, the rich and powerful who live the uncommon life—this has a fascination for us all, in comparison with which common life seems mean and dull, just as our eyes light up as we gaze upon the gorgeous colors of the rainbow, forgetting the common light of day. But as it takes all the colors of the rainbow to make the common light, so all heroisms and excellence go to make up the common life. In its entirety and intrinsic value, common life is more valuable

than all chivalry, romance, oratory, and poetry, just as the ocean is grander and weightier than all the clouds which spring from her bosom only to float in lofty disdain through the fields of air. All honor to common life because it is common, and a reverent study of the conditions for its betterment.

THE VALUE OF HEALTH.

Next to life the most precious possession is health—the harmonious coördination of all internal and external physical forces to secure the well-being of the individual. The conditions of health have been laid down as pure air, pure water, and pure food. These three "P.s" are prime factors of health. Pure life may well be added to the list, and even then all the conditions of healthy living have not been named. Atmospheric temperature and moisture are controlling forces in climate, and have intimate relations to health. The fact that the human body, amid wildly conflicting changes of temperature, must still maintain the heat of 98° F.—that to fall much below or rise much above that temperature causes disease, and if prolonged may cause death; and the further fact that many processes of secretion, excretion, and assimilation are delicately balanced against each other to obviate the effect of marked changes of temperature, all indicate the controlling influence of temperature over health and even life. One writer has tersely said: "Heat is life, cold is death."

THE SOIL IN RELATION TO HEALTH.

Since the soil must affect the composition of the air overlying it, has a profound influence upon the water contained within it, and has a marked control upon local temperature, it becomes evident that the soil and its physical condition must have a marked influence on the health of the inhabitants.

SURFACE DRAINAGE.

In Michigan the drainage of swamps and marshes, removing all stagnant surface water, has been so promotive of the general health that no one now questions its benefit. In a state where one ninth of the land was indicated upon the original surveys as swamp, the benefit of surface drainage was most obvious. Within my own recollection the malarial diseases of my state have been reduced one half, and the most potent factor in this reduction was drainage of swamps. No law ever placed upon our statute-book has been productive of more good and less evil than the law providing for compulsory drainage, where each land owner was made to bear his just part of the expense, and no churl could block the draining of a whole neighborhood because he chanced to control the outlet. This law has paid the state ten fold the cost by reclaiming a large area of once worthless land, and it has paid a hundred fold in promoting the public health.

UNDERDRAINAGE.

Surface drainage needs no advocate to-day, and I call your attention to a form of draining equally necessary, but the need for which is not so obvious. I refer to the underdraining of soils whose surface appears to be reasonably dry, but whose deeper recesses are full of stagnant water. This ground-water, as it is called by the Germans, is never to be mistaken for soil moisture or water held in the soil by capillary action, but it is the free water of the soil, which will flow under the action of gravity. This ground-water diminishes in a marked degree the agricultural capabilities of the soil, reducing the temperature, preventing soil oxidation, arresting the elaboration of plant food and preventing the spreading of the roots in the soil, because the roots of most cultivated plants will die in stagnant water. I do not propose, however, to discuss the agricultural value of soil drainage.

GROUND-WATER AND HEALTH.

The influence of ground-water on health is even more important than its influence on crops. It matters not how fertile the soil may be, if the farmer, by reason of sickness, is unable to sow the seed and gather the golden grain. The soil that cannot raise life-supporting crops may yet produce death-dealing disease. The careful researches of Pettenkofer of Germany, of Bowditch of Massachusetts, and of many other sanitarians, reveal the close relation between the prevalence of pneumonia, consumption, and low forms of fever, and the approach of the water-line to the surface of the soil. An investigation into the causes of an outbreak of diphtheria in New York in 1872, brought out the fact that many of the old water-courses and natural springs had been filled in years before, without making provision for draining the soil, and the disease seemed to be especially prevalent along the lines of these old water-courses. In an outbreak of cholera in Dublin in 1866, Dr. Mapother says two thirds of the deaths took place on or close to the old water-courses that had been converted into sewers or filled up with mud. Objection may be made that these diseases are caused by specific germs, yet these germs can propagate only in a suitable soil, and they find this in a body weakened by unhealthy surroundings.

I call special attention to the influence of ground-water, because people are only beginning to realize how profound is the influence of ground-water on the public health. This influence is exerted directly in three ways:

1. By making the soil and air above it cold.
2. By making both soil and air damp.
3. By generating malaria.

Indirectly the ground-water is the predisposing cause of a large number of diseases.

Let us have a little dry discussion on this subject from a meteorological

standpoint, using as data the following table of average rainfall by months at the Michigan Agricultural college for thirty years past.

MONTHLY AND ANNUAL RAINFALL.

Rainfall in.....	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Inches.....	1.86	2.11	2.56	2.40	3.08	3.77	3.38	2.81	3.10	2.59	2.23	1.96
Millimeters.....	47.244	53.594	65.024	60.960	78.232	95.758	85.852	71.374	78.740	65.786	56.642	49.784

Year, 32.85 inches; 838.390 millimeters.

This is the average rainfall in central Michigan. When we speak of so many inches or millimeters of rainfall, we seem to be dealing with small quantities of matter, but the gross amount is really large; thus one inch or 25.4 millimeters of rainfall means 112 tons of water to the acre, and the annual rainfall at the college exceeds 3,600 tons per acre.

The water which thus falls in rain may be disposed of in three ways:

1. Used up by growing plants and evaporated by their leaves and stems.

2. Flow away, either over the surface or by subterranean channels.

3. Evaporated from the surface of the soil.

Any remaining portion will be left in the soil as ground-water.

LOSS OF HEAT.

Let us follow our rainfall in these several ways. The rainfall for six months, April to October, is 18½ inches. Suppose an acre is planted to some crop that will produce twenty tons of vegetable matter, assume Knop's estimate that the crop will evaporate from its leaves during the period of growth 36 times its weight of water; then 720 tons of water—say 6¼ inches of the rainfall—will be used up by the growing crop, leaving 12¼ inches to be disposed of by flowage and evaporation. Suppose that by the combined action of these two agents, 6¼ inches additional of the semi-annual rainfall is disposed of, and the remaining 6 inches would flow away if subterranean channels were present; otherwise this mass of water can only be removed by evaporation. But evaporation is a powerful heat-consuming process. To evaporate one pound of water consumes enough heat to raise the temperature of five and a-half pounds of water from freezing to boiling-point. The evaporation of such a mass of water lowers the temperature of the soil to a surprising degree, with corresponding loss of the vital forces. To make good this loss of heat by unnecessary evaporation, and restore the normal temperature of such a soil, would require the heat caused by burning fifty-six tons of coal per acre. No wonder the farmer calls such a soil cold. To remove this water by flowing instead of evaporating will be a large addition to the available temperature of the soil during the growing season. Every tile that discharges five tons of water a day for six months saves an amount of heat equivalent to seventy-five tons of coal.

CONSERVATION OF HEAT.

Let me vary the illustration for the sake of emphasis, because the loss of heat by evaporation and the saving by drainage is so important that it cannot be placed in too clear a light. Suppose that a tile drain discharges constantly for six months a stream of water whose cross-section is one square inch and velocity two and one half miles an hour; how much coal will be required to evaporate the mass of water thus discharged? More than a thousand tons! Suppose the drain discharges for only six weeks of this period, and is dry the rest of the time, this six weeks' drainage would save the heat equivalent to 250 tons of coal. It is a physical necessity that a water-drenched soil should be a cold soil during our so called warm season. The evils springing from this cause are active all the year, but are more manifest in spring and early summer, the period when tile drains would be the most active. It is at this season, also, that animal and vegetable life alike demand warmth as they shake off the shackles of winter.

CHILLED AIR.

But the evaporation of so much water, producing cold, renders the air over such a soil damp and chilly. This result is a physical necessity. This damp and chilly atmosphere has a more serious influence than the simple feeling of discomfort. It has a most depressing influence on the human system, lowering its tone, enfeebling the vital powers, and acting as the predisposing cause of a long list of diseases, some of them the most destructive and incurable known to medicine. The depressing influence of the dampness and chilliness of water-soaked soil is not to be likened to the effect of an occasional wetting, as when we are caught in a shower. The chilly dampness of the undrained soil is persistent and unremitting, dragging us down with its cold fingers at all hours, at "noon of day and noon of night," as if we toiled and rested, waked and slept, in a perpetual drizzle of cold rain. It may seem a small force at first, but its persistent, untiring, and relentless pull tells upon the strongest at last, like the invisible fingers of gravity, which finally drags down all to a common level, whether towering oak or lordly hall. This depressing influence is not developed suddenly and distinctly: an hour, a day, a month, may show no marked deterioration, else men would flee from such places as from a plague-spot; but silently and secretly the sapping and mining go on till the explosion comes in sickness, suffering, and the sleep that is eternal.

SOIL-BREATH.

There are certain other conditions secured by drainage of the soil, which are essential to the health of the inhabitants, and one of these is aëration of the soil, or the passage of air through the pores of the soil. The air is entirely excluded from water-soaked soil; the entrance of air is prevented

and all interchange between the air and soil—all soil-breath—is prevented. Have you ever thought how everything breathes—animate and inanimate alike? You inspire and expire air continuously, and thus keep yourself in good condition, and so do your garments. The air penetrates every fibre of your wardrobe, passing in and out, and carrying out something it did not carry in. If your clothing was impermeable to air you could not tolerate it for an hour. The invisible waves of air wash and purify you every hour.

Let me illustrate this: I cover the bowl of this tobacco pipe with the skirt of my coat, and bringing the stem of the pipe before the candle-flame, you see I can easily blow air through several thicknesses of cloth and sway the flame by the current of air. I do the same thing with buckskin, a felt hat, leather, and everything we wear except India rubber.

If you suppose your clothes do not breathe, place them in an air-tight box and strangle them for a few months, when the musty smell will convince you that your clothes must breathe to remain sweet and wholesome. Even the solid bodies, such as wood and stone, are still washed and infiltrated with air. Here is a stick of red oak a foot long, and you see I can readily blow air through it. Here is a roll of mortar, such as masons use in plastering walls, and you see I can, with the slightest effort, blow air through six inches of dry plaster.

Not only can the air pass through these bodies, but it does pass under natural conditions, and plastered walls breathe. In plastered rooms where the walls have been left undisturbed for some time, you see the position of every beam and joist, and even the lath, by the lighter color of the wall. The part of the wall occupied by the plaster only is more permeable by air, which, in passing through, leaves the dust behind, forming a brown streak. The air holds a fine dust in suspension at all times, which dust will be filtered out and left behind, when this air passes through a plastered wall; where the air passes most rapidly, the most dust will be deposited on our filter, and where less air passes, a corresponding less amount of dust will be deposited: the solid beams and joists prevent the escape of air from the plaster, and thus limit the amount passing through the wall surface next them; the lath will to less extent obstruct the passage of air, while the space between the lath entirely filled with the plaster will most readily permit the passage of air. Thus a glance at our wall filter, especially if it has been long in use, will enable us to determine the position of all the frame-work of the room, concealed by the plaster until revealed by the tell-tale dust.

Let me digress for a moment to speak of this subject of wall respiration, and point out how admirably a plastered wall is fitted to make the walls of a healthy dwelling, because it permits the free passage of air, without causing draughts or unhealthy currents. Let us see how this wall-respiration may be affected by some common practices. I am often asked, what is the influence of wall-paper on the healthfulness of a room? Let us test this question by seeing whether air will readily pass through

wall-paper. I place a piece of wall-paper over the bowl of this pipe and try to blow air through it: you see the flame is only very feebly swayed; but if I use this filter paper in the same way I readily blow out the flame. The sizing used to lay on the colors of wall-paper fills the pores of the paper so as to nearly prevent the passage of air, even when we blow forcibly; but with the additional paste used to fasten the paper on the wall, the papered wall becomes impervious to air. Over the plastered mouth of this pipe I have pasted some thin wall-paper; it is now dry, but you see I cannot blow the least air through it. A papered wall is a strangled wall, so far as wall-respiration is concerned. When a wall is calcimined, the whiting and coloring material being laid on with a solution of glue, the wall becomes impermeable by air. Here is a pipe, the mouth of the bowl filled with mortar, and this covered with calcimine; it has been thoroughly dried, but only a minute trace of air can be forced through it. The same is true of a painted wall. Here is another pipe filled with mortar; I have very thoroughly whitewashed the exposed face of the mortar, applying two coats of whitewash; yet you see I can blow air through it nearly as easily as I can through rough plaster.

The amount of air that will pass through this diminutive surface is small, but when we come to apply it to the dimensions of a room, it becomes large. The experiments of Professors Marker and Shultz show that the passage of air through brick walls is by no means difficult. The difference of 20° F. in temperature between out-door and in-door air will cause the passage of about eight cubic feet of air each hour through every square yard of wall-surface made of brick.

The soil also breathes. Under proper and sanitary conditions the air passes in and out of the soil with every motion of wind. You will be surprised to see how readily air may be made to pass through soil. Here is a jar seventeen inches high, filled with compact, dry soil, the top closed with a doubly-perforated cork; through one hole a glass tube passes to the bottom of the jar, but terminates above in a horizontal jet; through the other hole a tube passes to the space above the soil. On blowing into this tube gently you see that the air passes down through fourteen inches of soil, because it escapes freely at the horizontal jet of the other tube, as is shown by blowing the candle flame before it.

WATER STOPS SOIL-BREATH.

But all this is changed in the presence of water in these materials. If the walls of the house are wet, the passage of air is prevented. I wet this half inch of plaster, and you see I cannot force the air through it. In the same way, if the soil is drenched with water, the passage of air is prevented. I have here a bottle filled with soil saturated with water, and you see how the passage of air is prevented—that the air will pass through seventeen inches of dry soil easier than through four inches of wet soil. Indeed, the air will not pass at all through this thin stratum of wet soil, but will readily pass through this thick stratum of dry soil. You thus see

that *a drenched soil is a drowned soil;* that all the conservative influences secured by the interaction of soil and air are cut short by the presence of ground-water. You see that such a soil must be unhealthy aside from the cold and damp quality of air which overlies it, though these are themselves prime factors of disease.

SANITARY DRAINAGE.

Drainage on the large scale for sanitary purposes is almost unknown. Most of our knowledge on this subject is derived from drainage undertaken for agricultural purposes. But whatever the purpose for which drainage is undertaken, the benefit to the public health is always pronounced and unmistakable. Governor Porter of Indiana, in his address of welcome to this Association in Indianapolis ten years ago, referred to the benefits of sanitary drainage in these words: "Underdrainage has everywhere been followed by a great lessening of sickness, and intermittent fever, once so common, has become so rare that it is a good deal less prevalent than in some of the oldest states. Our laws relating to drainage have been recently much improved, and a disposition to relieve the soil in every portion of the state of all excess of moisture tending to lessen its productiveness and to bring on sickness, is everywhere evident."

DRAINAGE OF DWELLINGS.

If the fields require draining, much more the ground for the dwelling. The house you propose to make your home and live in, you surely would not place over such a death-trap as a water-logged soil. The ground which is to be the site of a house should be free from stagnant water, both the surface soil and the subsoil. If you do not *know* that the subsoil is dry, dig down eight to ten feet and see if the hole remains dry, even if no drought prevails. If water filters into the excavation, remove it by thorough drainage as the first condition for a healthy dwelling.

Some persons assume that a sandy or gravelly surface insures a dry subsoil, and that it is difficult to secure a satisfactory foundation on a clay soil. Both assumptions are erroneous: the porous surface soil may have a water-soaked sub-soil, and the stiff clay may be made dry and safe by underdrains. A tract of land in the suburbs of Detroit was so wet and swampy that it was supposed to be nearly on a level with the river, though it was in reality seventy feet above the river. During the wet season it was a preserve for frogs and mosquitoes, and during the dry season the baked and cracked soil seemed to be gaping and yawning with ague and fever. It assuredly seemed an unpromising spot for human habitations. Some enterprising capitalists undertook its reclamation, and sank sewers ten feet below the surface with laterals for every cellar, the whole serving both as surface and subsoil drains. The tract has been built up into a prosperous and healthy portion of Detroit. Examples of this kind might be quoted by the hour. But when houses are built upon retentive and water-soaked

soils, while no means are employed to draw off the ground-water or ward off its effects, the harvest of woe is sure, though it may be slow to ripen.

THE MARCH OF EVIL.

To the thoughtful mind one of the saddest sights is the endless succession of evil arising from preventable causes. In his inaugural address as Lord Rector of the University of Glasgow, John Bright drew a striking picture of the endless procession marching on through successive generations of ignorant, impoverished, and embruted men, with their sad-eyed and hunger-pinched wives and children, all continued by the enormous taxes imposed to maintain the conditions and appliances of successful war in times of profound peace. In a less dramatic but no less true light we may draw the lineaments of physical evil, casting its long shadow down the corridors of time. We have histories of races and dynasties, their rise, progress, and decline, the causes which brought them into prominence, and the forces which brought them to their downfall. Why should not a soil have likewise a history of its own and take on a personality as truly as a race? Let us scan the features of such a farm and follow the history springing from its inherent qualities. The surface is somewhat level or gently undulating, the soil a tenacious clay, strong in the elements of enduring fertility if the physical conditions are properly adjusted. The natural drainage is very slight, except that much of the surface-water can run off by overflow, but the tenacious quality of the soil prevents all deep drainage; the deeper soil is water-soaked in spring and early summer, and at other times when heavy rains fall; gate and fence posts are heaved by the frost, winter wheat and clover are half uprooted by the same force. Work is late in the spring because the soil is cold and wet, crops are slow to start and slower to ripen. The "farmer has a hard row to hoe." A hopeful and cheerful spirit is conspicuously wanting, because he has generally poor success with his crops, "bad luck," and because he has the continuous depression of poor health. The furrows seam his cheeks early, his shoulders stoop when he should stand erect in manhood's prime.

Indoors the wife soon fades, the bloom and laugh of happy girlhood give place to the chronic invalidism of motherhood. Children are born only to die, or linger on in joyless ill-health. The family is finally blotted out, unless a surviving son may hand down this heirloom of sorrow to another generation, when the farm passes into other hands, to repeat the same story. And thus we see in hopeless succession, the generations of joyless owners pass before our eyes. The doctor, the undertaker, and the sheriff enter in succession to shift the stage scenery, but the same sad drama goes on with little variation.

If nature had only planted a gravel bed under his whole farm, outcropping on some streamside, so the cold waters might laugh and sing on their way to their home in the sea, thus warming up his soil to early fruitfulness, and warming up his soul to the real joy that springs from

hope and health, bringing light and laughter to the housewife by letting the tinkling spring-drop replace the scalding tear-drop, how changed the history of such a farm! Competence, and even abundance, come from the grateful returns of his well-conditioned soil, as the earth teems with her harvests. Health comes to crown the mercies of the year. His children rise up to call him blessed, instead of beckoning him with their shadowy fingers to the spirit-land.

Is this all a figment of the imagination? Can you not tell of farms where many of these features can be traced in the water-soaked soil, but finally reclaimed and regenerated by thorough drainage?

Let me close with an illustration given me by the late Bishop Haven:

Two brothers in Vermont, of strong and vigorous stock, and giving equal promise of a long and active life, married wives corresponding in promise of future activity. They both had chosen the healthiest of all callings—farming. One of the brothers built his house in an open and sunny spot, where the soil and subsoil were dry; shade trees and embowering plants had a hard time of it, but the cellar was dry enough for a powder magazine; the house in all its parts was free from every trace of dampness and mold, there was a crisp and elastic feel in the air of the dwelling. The farmer and all his family had that vigorous elasticity that reminds one of the spring and strength of steel. Health and sprightly vigor is the rule, and sickness the rare exception. The farmer and his wife, though past three score, have yet the look and vigor of middle life.

The other brother built his home in a beautiful, shady nook, where the trees seemed to stretch their protecting arms in benediction over the modest home. Springs fed by the neighboring hills burst forth near his house and others by his barns; his yard was always green, even in the dryest time, for the life-blood of the hills seemed to burst out all about him in springs and tiny rivulets. But the ground was always wet, the cellar never dry, the walls of the rooms often had a clammy feel, the clothes mildewed in the closets, and the bread molded in the pantry. For a time their native vigor enabled them to bear up against these depressing influences; children were born of apparent vigor and promise, but these one by one sank into the arms of the dreamless twin brother of sleep under the touch of diphtheria, croup, and pneumonia. The mother went into a decline and died of consumption before her fiftieth birthday, and the father, tortured and crippled by rheumatism, childless and solitary in that beautiful home, which elicits the praises of every passer-by, waits and hopes for the dawning of that day which shall give him back wife and children, an unbroken family and an eternal home.

"Look on this picture, then on that."

V.

THE RELATIONS OF THE OFFICIAL WEATHER SERVICE TO SANITARY SCIENCE.

By MARK W. HARRINGTON, Chief of Weather Bureau,
Washington, D. C.

Since man is immersed in the aërial ocean which forms the subject of study on the part of the meteorologist and climatologist, it might reasonably be expected that the results obtained by their labors would prove of the highest value to physicians and other students of sanitary science. This expectation is rendered all the more reasonable by the fact that the work of the meteorologist has proved of the greatest value to the business man and farmer. It is perhaps not too much to say that this reasonable expectation on the part of sanitary students has not been fully realized, and, as a first step toward improving the relations of these two important branches of science, it is proper to inquire what are the reasons for this failure.

First, it may be desirable to point out in what directions meteorological data would be likely to be of use to physicians and others interested in physical man. The bearing of weather prediction on sanitary science may be dropped without discussion, not because it is not important, but because it is now well established in many countries, its lines are well laid out for countries where it is still to be established, and its service to sanitary science is like that to all other forms of human activity—that is, the forecasts are presented to sanitarians as to all others, and they can select from them such as are useful and can do this without advice from meteorologists.

Aside from forecasts, meteorological work appears to be of importance to physicians in three different ways:

1. In the reduction of their observations to systematic climatology, thus giving the broad features of the climate of different parts of the earth. With this can be studied the relations of man to climate in a general sense, such as the relations of climate to race, to the different forms of industry, and to general diseases.

2. In giving the climate of health resorts. The data of general climatology are not sufficiently detailed for this. The ordinary meteorological observations need to be reduced and combined on a special plan (and one not always followed by meteorologists) before they can give the information which a physician needs in order to decide whether or not he may send his patient to a given health resort. Moreover the

physician needs some data which are not, by meteorologists at least, considered properly and purely meteorological. These will be referred to later.

3. In giving the data of weather to enable the physician to correlate any special pathological phenomenon, as fluctuations of a disease, or the appearance of an epidemic (as, say, yellow-fever) with the elements of weather which preceded, accompanied, or followed.

Now all these things require that the data of weather and climate be on tap, so to speak, for the benefit of sanitarians and physicians. But this is already done. In each of the categories above mentioned the data already exist in an amazing, in fact fairly appalling, fulness. The United States weather map has extended now in an unbroken bi-daily or tri-daily series for over a score of years and it has been so broadly scattered that it can be consulted in almost any country, and the same is, *mutatis mutandis*, true of a dozen other weather services. The world has been so completely covered with stations that fairly exact climatological maps now include its entire surface. If there is any lack it is in the case of health resorts, but for many of these the ordinary meteorological data exist in abundant fulness. And yet, to judge from my correspondence and from verbal statements, the physicians and other sanitarians do not feel that their wants are fully met yet.

There must be reasons for this, and they are not far to seek. The following may be mentioned as the principal ones, though there are doubtless others:

1. The data desired by sanitarians and physicians may not be furnished them in a form suitable for their use. For instance, among the temperature data, for health resorts especially, the physicians especially desire the variability. Two places may have the same mean temperature, say 45° F.,but may be as far apart as the poles in their availability for invalids. One may have an occasional change of 40° F. in a few hours, while the other may not have an absolute annual range of that amount.

Meteorologists already compute and record variability of temperature and other elements, but apparently their method of doing this is not suitable for the physician. Again, the pressure given by meteorologists is that reduced to sea-level, while that desired by the physician is the actual or unreduced. The humidities usually given in meteorological tables are the means of relative humidities, which are not only uninstructive as means, but are also uninstructive to the physician as a meteorological element, inasmuch they are compound, depending on both temperature and the vapor contents of the air. The moisture really appears to be of high sanitary importance. It is certainly of great weight in causing subjective feelings of comfort and discomfort, but it is comparatively neglected in climatological studies. Other cases of lack of availibility of climatic data for the use of physicians could be pointed out, but it is sufficient to have indicated their general character.

This lack from the standpoint of the physician and sanitarian can be

remedied. It is simply a question of handling observations already taken. An absolutely necessary preliminary is, that the proposed beneficiaries should indicate clearly just what they want and in what form they wish it. Such a movement could, with great propriety, be initiated in such an association as this, and the purpose of this paper will be fully attained if it can prevail on the physicians and sanitarians here assembled to formulate their needs, so far as concerns data already collected by governmental meteorological services.

2. There are, however, certain things of great importance in matters of health and disease of which the modern meteorologist takes little or no account, and these are much more important to sanitarians than the data just mentioned. I refer to sunshine, to the purity or impurity of air, to the condition of the soil and the disposal of rainfall, and to the active oxidizing agents in the air familiarly classified together as "ozone." These are the atmospheric things that sanitarians are especially interested in, but with the exception of sunshine these do not form any part of the field of the meteorologist as usually defined.

Automatic sunshine records are now carried on at very many stations, and are to some extent published. The work of the stations in this direction will grow, and with the lapse of years the results will be, so to speak, codified and rendered generally available.

As to the purity of the air, disposal of waters, state of the soil, and ozone, the meteorologists will generally enter a plea of *non possumus*, at least so far as regards regular official weather stations. In the case of ozone, the observations can easily be taken, but they are so lacking in scientific discrimination and in accuracy of measurement, that a responsible head of a great weather service would prefer, before loading his hard-worked and under-paid observers with additional duties, to wait until the methods had become at least so perfected that he might know what it was that was being measured.

In the case of ozone, the meteorological plea is, properly speaking, *non volunt* while in the others *non possunt* is the proper plea. The purity of the air depends on the presence or absence of foreign gases or of dust. The former requires chemical analysis, and cannot be performed by any of the simple and speedy methods of a meteorological observing station. As to the dust, there are fairly speedy methods of approximate counting of the particles, but this does not reach the requirements of sanitary science. Of two particles exactly alike to the counter, one may be inert, while the other may have within it the potentiality of an epidemic of cholera. To differentiate these, a laboratory, plenty of time, and the skill of the trained hygienist are necessary. Much the same is true for the data relating to the condition of the soil and the disposal of the rainfall after it has reached the earth. These are all matters for special treatment in laboratories where the methods are in only small part meteorological.

In conclusion, attention should be called to the comparative neglect of meteorology (which in its broadest sense includes climatology) in the

schools, more especially in the medical schools. Education in this line is as yet, for the most part, confined to the limited range of climatic ideas to be found in the physical geographies, and, while some sanitarians are well informed about climate, and a few are professional students of the subject, it is generally true that even such fundamental terms as normal, relative humidity, and cyclone are not understood and appreciated. It may be said that this is due to the lack of good pedagogic literature on the subject, but the difficulty lies further back than that. The literature will be furnished when there is a demand for it. The difficulty lies in the lack of education on the subject. Meteorology is as much entitled to a place in a course of study as any other science, and it should be one of the fundamental sciences for the medical student.

APPENDIX.

SUGGESTIONS FOR METEOROLOGICAL DATA IN FORM TO BE AVAILABLE FOR SANITARIANS.

Atmospheric Pressure.

This is an unimportant element for hygienic use. The variations of pressure at sea-level are generally not greater than a tourist would undergo in being carried to the top of the Washington monument, and seldom greater than would be undergone on being carried to the top of the Eiffel tower. The corresponding natural changes would take several days or weeks, while the changes of elevation mentioned, take only fractions of an hour. Apparently the only barometric element of use to sanitarians is,—

I. THE AVERAGE OF THE ACTUAL PRESSURES (that is, pressures unreduced for altitude).

Atmospheric Temperature.

For hygienic purposes the details of temperature are of interest, as, on a sunny day, the temperature may differ greatly in short distances; depending on the exposure and the character of the surroundings. The meteorologist has defined the air temperature as that of the free air at about the height of a man, the thermometer being protected from all direct radiation. With such a definition the temperature data which could be prepared from observations now taken, and which might be of use to sanitarians, would appear to be as follows:

II. THE MEAN TEMPERATURES of the hours, months, seasons, and year.

III. THE MEAN MAXIMA AND MINIMA for the months, seasons, and year.

IV. THE ABSOLUTE MAXIMA AND MINIMA for the same.

V. THE MEAN AND ABSOLUTE AMPLITUDES for the same.

VI. INTERDIURNAL VARIABILITY, i. e., the mean change in mean daily temperatures.

VII. LIST OF SHARP CHANGES of temperature of short duration.

VIII. FREQUENCY OF FREEZING DAYS (mean temperature less than 32° F.);

of FROST DAYS (min. temp. below 32° F.); of HOT DAYS (max. tem. 86° F.); and of VERY HOT DAYS (max. tem. 95° F.).

IX. MEAN AND ABSOLUTE DATES OF THE LAST AND FIRST FROSTS.

X. MEAN AND ABSOLUTE DURATION OF FREEZING, OF HOT, AND OF VERY HOT WEATHER.

XI. MEANS OF TEMPERATURES OF EVAPORATION, i. e., of the wet-bulb thermometer. This is an element which has not been discussed, so far as known to the writer, though Lieutenant Glassford suggested it to him some time ago. Its significance lies in the fact that it would approximately represent the temperature of the person in hot weather. It would help to distinguish between the distressing moist heat of some stations and the more endurable dry heat of others. It should probably be given in means, and associated with the corresponding air-temperature (or temperature by the dry-bulb thermometer). It could be given thus:

Air-Tem.	Mean.	Tem. of Evap.
70° to 80°	75°	. . . .
80° to 90°	85°	. . . .
90° to 100°	95°	. . . .
100° and more	. .	. . . .

A similar table for low temperature might be of use, as it is thought that dry cold weather is less hard to endure than wet cold weather.

Aqueous Vapor in the Air.

With the dew-point and the actual temperature known, it is easy to take from tables the relative or absolute humidity, and also the deficiency of vapor which has been recommended by Buys-Ballot, Wild, and others as of considerable hygienic importance. The same data can be taken from the mean values of temperature and dew-point. Hence it may be well to include in data of hygienic interest:

XII. THE MEAN DEW-POINT TEMPERATURES for the months, seasons, and year.

The resulting humidities would be somewhat artificial and many would prefer the means of the actual values, giving

XIII. THE MEANS AND EXTREMES OF THE ABSOLUTE HUMIDITY (pressure of vapor).

XIV. THE MEANS AND EXTREMES OF DEFICIENCY OF AQUEOUS VAPOR, i. e., the amount needed to bring the absolute humidities to saturation.

XV. THE FREQUENCY OF THE VALUES OF RELATIVE HUMIDITY by months and year. The mean value of the relative humidity can probably best be obtained from the mean dew-point.

Cloudiness and Sunshine.

The ordinary means of observations of cloudiness are confessedly unsatisfactory and would not be very significant of the distribution of sunny or cloudy weather. A better datum for hygienic purposes would undoubtedly be the following:

XVI. MEAN NUMBER OF CLEAR DAYS (0.2 or less of clouds), FAIR DAYS (0.2 to 0.8 cloudy), AND CLOUDY DAYS (0.8 or more clouds).

XVII. MEAN AND MAXIMUM NUMBER OF CONSECUTIVE CLEAR AND CLOUDY DAYS for each month. The percentages of cloudiness could be profitably replaced by those of sunshine; and the latter would be most useful in the form of probability of sunshine—that is, the ratio of hours of sunshine to the total number of hours, or

XVIII. PROBABILITY OF SUNSHINE for each hour.

XIX. THE SAME for each month, season, and for the year.

Rain and Snow.

XX. AMOUNT OF PRECIPITATION by months, seasons, and year.

XXI. EQUALIZED MONTHLY PERCENTAGES OF PRECIPITATION by months, seasons, and year.

XXII. PROBABILITY OF DAYS WITH NO RAIN (0.01 inch or less), and of days OF HEAVY RAINS (1 inch or more), by months, seasons, and year.

XXIII. CASES OF TORRENTIAL RAINS.

XXIV. FREQUENCY OF HAIL.

XXV. FREQUENCY OF FOG.

XXVI. FREQUENCY OF THUNDERSTORMS.

XXVII. AVERAGE AND EXTREME FIRST AND LAST DAYS OF SNOW.

XXVIII. AVERAGE AND EXTREME DURATION OF UNBROKEN SNOW COVERING.

Winds.

XXIX. FREQUENCY FROM EACH DIRECTION AND OF CALMS by hours, months, seasons, and year.

XXX. MEAN VELOCITIES by hours, months, seasons, and year.

XXXI. FREQUENCY OF HIGH WINDS, i. e., of winds from 30 to 40 miles, 40 to 50 miles, 50 miles and over, per hour.

XXXII. STATISTICS OF HOT OR COLD WINDS and duration of continuous wind from a single direction.

XXXIII. WINDROSES for temperature, humidity, and precipitation.

VI.

INFLUENCE OF CLIMATE ON THE PROGRESS AND SEVERITY OF PULMONARY TUBERCULOSIS IN THE UNITED STATES OF MEXICO.

By DR. A. J. CARBAJAL,

Medical Officer of the Superior Board of Health.

Mexico.

Among the principal and most powerful biological modifiers that affect the human system, is the climate of the region one inhabits; now making its influence felt in an unfavorable manner, continually or periodically, occasioning acute illnesses more or less dangerous; now destroying or slowly invigorating the dynamic force of life; now accelerating the fatal progress of certain sufferings, or opposing certain eminently favorable conditions that would bring them to a happy end, completely re-establishing the broken health.

During a period of 23 years of civil and two of hospital practice, in my professional studies in the city of Mexico, my attention has been called to the progress and serious character, so diverse, that is taken by tuberculosis, in our country, according to the geographical region in which we consider it.

I know the disease personally in the three zones, in which Mexico is generally divided, under the aspect of physical geography, by having practised in the following states: Yucatan, Sonora, both warm, dry climates; Querétaro, temperate, dry; Puebla, Morelos, temperate, damp; and Veracruz, warm, damp; by neighborhood and data from patients and colleagues, the state of Sinaloa and that of Chihuahua, and finally the territory of Lower California.

I propose to resume in this lecture the results of this personal observation and of the data from former works, which relate to the subject, and are by the Doctors Jourdanet, Licéaga, Mexia, Breña, and Orvañanos.

Dr. E. Licéaga has divided the climate of the great central table-land of Mexico into three classes, considered under the aspect of their influence on tuberculosis.

1. There are localities in which pulmonary phthisis is unknown.

2. There are others which do not present an absolute immunity to their inhabitants, but phthisis rarely shows itself.

3. There are localities where the disease shows itself in the natives,

but the climate is magnificent for invalids who have lived in other climates.

As an example of the first, the author mentions Zacatecas. In effect, according to the respective table at the end, the mortality from tubercular diseases in that state is 0.92 per cent., and from pulmonary tuberculosis 0.37 per cent., which are really insignificant figures. We can add Tenango of the valley in the state of Mexico, which is bounded on the north by the valley of Toluca, the highest in the republic, where there are districts like the Partido de Temoaya, that are at an elevation of 3,790 yards above the level of the sea. In Tenango not a single case of phthisis has been noticed during a period of 12 years, according to references from a well-informed person, who, in his administrative duties, had occasion to know it.

Of the second class, he points out Oaxaca, citing the testimony of several distinguished physicians, Doctors Fenelon, Garmendia, Mexia, and others, who declared that there the disease is rare. [1]

The accompanying table shows that in that state the mortality from tubercular diseases, pulmonary phthisis, mesenteric tables, is 2.08 per cent., a very moderate figure.

Among those of the third class the author indicates the city of Mexico: this gives a mortality, from all tubercular affections, of 8.17 per cent. and from pulmonary phthisis and granulia 6.55 per cent.

We ought to add according to the latest acquired data, villages where the mortality is notably less than in the city. Nearly all in the Federal district do not pass two per cent.; and some one of one per cent., like Atzcapotzalco and Tlalpam, as also Tepotzotlan in the state of Mexico.

In reference to the temperate climate we will say that they belong to the second class, save with a difference in the humid ones; that the consumptives who come from other localities do not obtain a marked improvement, as is the case in Oaxaca. I never saw a consumptive improve in Atlixco, whether he came from the state of Veracruz or from the city of Mexico. With regard to warm climates, we ought to divide them into two categories.

1. Tuberculosis is not very frequent among the natives, but when it appears, it is in the form of rapid or galloping consumption, nevertheless, the climate is excellent for those who are pre-disposed and come from a cold region; for example, Senora, north of Sinaloa, west of Chihuahua, and Lower California.

2. The disease is very frequent, often hereditary, it develops rapidly, producing a high mortality: example, Yucatan, Campeche, and Veracruz. The data that I present of the city of Veracruz are truly surprising. In the year 1887 the deaths from pulmonary consumption were 22.66 per cent., which is enormous.

In a high zone the disease tends to a chronic form, localized and tending relatively to its cure. Hœmoptysis very seldom is copious; moder-

[1] Lè plateau Central du Mexique (Mesa Central) consideré comme station sanitaire pour les Phtisiques. Memoire lue au Congrés de Berlin, par le Dr. E. Licéaga, 1890.

ate and intermittent is the fever; moderate also the sweats, alternate with diarrhœa in the last stage. The patient dies exhausted by colliquation, which lasts for years in the deepest marasmus; but he has some probability of being cured if he submits to a proper medical and hygienic treatment. The observations of Dr. Liceaga, which reach over a period of twenty years, those of Dr. Jourdanet and of Dr. Jecker, still earlier, do not leave the smallest doubt. The first says, "I have had no time to take from my notes the number of consumptives whose cure is formally entered from among those who have become so, while living in the capital, but the number is considerable. Neither has it been possible for me to extract from these same notes the number of consumptives, who, coming from the shores of the Gulf or the Pacific, have recovered their health on the Central table-land, or have experienced such alleviation that they have been able to resume their business or their pleasure, the same as perfectly healthy people, but I am certain that the number is even greater than the former." Dr. Jourdanet, after making various observations on consumptives of our own hot climates and of Europeans who have found great improvement by living in highlands, says that, speaking with Dr. Jecker in Europe about the comparative progress of tuberculosis in Mexico, that distinguished physician assured him that phthisis is very seldom in this capital and that consumptives from the coast found great alleviation here. His experience proclaimed results still more interesting, and he affirmed that in his sight, patients had recovered from this terrible illness and afterwards enjoyed perfect health.[1]

During a period of three years, being an assistant practitioner in prison, I witnessed and made numerous autopsies consequent on deaths by accident, by alchohol, or by wounds; very often we found calcified tubercles in the lungs, small cavities or their vestiges healed and old pleuritic adherences. Nevertheless I ought to add that in Yucatan the same may be noticed, from what I am told by Dr. Peon Contreras, with the difference that here we see it in adults and there almost exclusively in persons of advanced age. Neither ought we to forget that in Europe the same observations have been made and that for some time back (Cruveilhier), which demonstrates two things: 1st, that tuberculosis is much more frequent than is shown by tables of mortality; 2d, the possibility of its cure.

In a temperate climate the progress of disease is not so typical, it sometimes appears like that of a cold climate. In Cuernavaca I saw a consumptive who, being given up in the capital, went to seek amelioration and lived more than twenty years. In Altixco they do not experience the same improvement as in San Juan del Rio, when the disease is in its second stage.

I think that any climate whose temperature is above 28 ctgs., is notoriously prejudicial when borne for six months or more in the year, because it exposes the patient to the dangers of the tropical zone.

[1] (La Mexique et l'Amerique tropical. Dr. D. Jourdanet, 1864.)

There are three symptoms of notable intensity that concur to accelerate the progress of tuberculosis in a hot country, and they are hœmoptysis, fever, and sweats. The first are in such abundance that they put the patient's life in serious danger: they are observed quite at the beginning, and are running hemorrhages or irritating, as the ancient pathologists called them. It seems that the pulmonary parenchyma and its vessels have acquired an exceptional fragility. Real pulmonary apoplexies can even be produced in places where habitually there is no tubercular infiltration as the basis; and the blood re-absorbed there remains a cavity, which is not the result of tubercular fusion, as I saw in Cordoba in the case of a young man of twenty (1875). It is not rare for a patient to lose 300, 400, or 500 grammes of blood in one attack. What I saw in Cordoba in several patients is what passes also in Yucatan, Veracruz, and Sonora. One circumstance demonstrates unequivocally the prejudicial influence of climate in this respect. If the patient is removed to a high elevation the hemorrhages diminish or disappear; if he returns to the warm climate before there is a pronounced improvement, they re-appear. Dr. I. Martinez del Villar attended a consumptive who had come from Veracruz. After some months he had improved in a marked manner, but still it was not prudent for him to return; nevertheless, he insisted upon doing so against the wish of his medical adviser. Within a month he suffered from a hemorrhage, to which he succumbed. "In Veracruz," says Dr. Mexia, "in tuberculosis hemorrhage is the rule, in Mexico it is the exception. Even more: some hemorrhages by themselves alone seriously compromise life."

In Senora this symptom is serious, but has not the same importance that it has generally on the Atlantic coast.

Fever is another symptom that presents a different aspect. It appears in the same manner on both coasts, a little more intense on the Pacific; it is not intermittent, but remittent or almost continuous pseudo. It is of an indomitable tenacity, generally 38.5 m. the morning and 39.5 or 40 at night.

The influence of climate is also undoubted on this point, as shown by an observation of Dr. Mexia: "At the end of the year 1886, Mr. T. P., suffering from pulmonary consumption in Mexico, had frequent attacks of coughing, hectic fever, complete distaste to food. During the beginning of November, being desperate on account of the frequent fogs in the capital and the consequent cold weather that would not allow him to go out, he determined to move to Veracruz, and, against our advice, he did so. I saw him at the end of December in such a serious state that not only did he not recover but had to take his bed, which he kept till his death, the 25th of December. From the time that I arrived in Veracruz the fever was never lower than 40, and all the symptoms so aggravated that it was not possible to alleviate them."

With regard to the perspirations, which is another obstinate symptom, they greatly contribute to the lowering of the patient, who dies without reaching that grade of marasmus that we notice in Mexico. The patient

is, notwithstanding, profoundly debilitated; and diarrhœa from 8 to 15 days is enough to accelerate his end. The duration of pulmonary consumption in hot climates is ordinarily about six months, very often of four or five, and very seldom the chronic. The most rapid that I have seen was in Senora, only 20 days.

Upon what cause depends this considerable difference in the progress of the disease?

The explanation may be of great interest as regards practise in the case of patients who cannot leave the climate that is injurious to them, and it would be possible to find a means of retarding the progress of the disease, which, if once declared, has no other remedy, but at least the discoveries recently made in science permit us to do something to benefit the persons who, being always near a patient, are exposed to contagion, and if affected would succumb in a short time.

We know positively from the works of Villemin and Koch that this illness is infectious and contagious. From the moment that it acquires a terrible intensity in warm climates, especially humid ones, we must admit that the bacillus finds in that atmosphere the most propitious conditions for its growth, now more actively multiplying or producing a more energetic pyrotic poison. The primitive bacillus infection is very noticeable from its intensity, in hot climates there are greater facilities for finding it; the secondary infection, from suppuration in the third period, is comparatively insignificant, because the extraordinary strength of the first gives no time to produce the second. In climates of great elevation, where the air is rarefied and aseptic, the temperature cold or temperate, dry or moderately damp, the microbes do not find favorable conditions for their life or reproduction. A transparent atmosphere, brilliantly illuminated by a radiant sun, contributes to the destruction of the microbes. (Arloing.) Under these conditions the bacillus infection is frequently only moderate; when already established and existing, the second will supervene if the cavities have been produced.

Hecticism is a kind of septicemia, which does not improve in hot climates or in temperate climates that are low and damp; the reason probably being that these substances, encrusted and infiltrated in the lungs, also find those conditions favorable to their growth. Thus it happens that consumptives who have reached the third period become worse if they seek a warm climate. Only if hecticism is very slow or non-existent, as sometimes happens in tuberculosis apyretic cases for long intervals, the patient will bear the climate for a long time without inconvenience, like a patient who was able to live in La Paz, Lower California, for six years, after having left the city of Mexico—Mr. P. E.

Social conditions add their influence to that of climate; while in Sonora one lives in the open air, even to sleep, on account of the excessive heat, and conglomeration is unknown. The food of the lower classes consists of maize, meat, cheese, beans, *pinole*, and very few vegetables, and although tuberculosis takes a serious form, it is rare, less than two per cent. of the general mortality, according to my calculation; in Vera-

cruz the people live in crowded houses, with little ventilation, and therefore breathe impure air, we are told by Dr. Mexia, and tuberculosis, as we have already mentioned, is the cause of an extraordinary number of deaths. I believe in Cordoba it is less frequent, but its progress is equally as rapid; the town is smaller and there is less crowding. It would not be prudent to recommend sleeping in the open air in these places on account of malaria. These facts are important because they allow us to suppose that contagion is probably a most important factor to explain the frequency of the illness in Veracruz.

The truth is that it would be enough to admit the infection of the houses, to me an almost certain fact, according to the data of Dr. Mexia, but it is difficult to understand that many cases of contagion are not presented, given the conditions of domestic life among our people and its utter want of precautions to avoid it. In Cordoba I did not see a single case that could be attributed to this means of propagation (1874 and 1885).

This doctrine of infection explains an apparent contradiction. How is it possible that a zone of such altitude, cold, where inflammatory affections of the lungs are very frequent and serious, as the valley of Mexico and Zacatecas, can constitute a favorable climate for tuberculosis; and the hot or temperate one be prejudicial when the former diseases take a less serious character (excepting Veracruz)? It is scarcely ten years since we were able to give the explanation and it is the one already indicated. Distinguished Mexican and European physicians considered tuberculosis of inflammatory origin, before the epoch just mentioned, and what the pathogenic cause of such inflammation was, was unknown; and in this ignorance warm climates were recommended to avoid the cold and sudden changes of temperature.

There is a very important distinction to be made, in my opinion, between the warm, dry climates of the shores of the Pacific and the humid ones; the difference they present is enormous to persons from other regions, who have not a hereditary pre-disposition. The former are very good, the latter dangerous. When a person of delicate constitution, of lymphatic temperament, subject to frequent prolonged and feverish bronchitis, passes to the Pacific coast, to a warm, dry climate, his constitution improves, the bronchitis is less frequent and of a shorter duration, assimilation is more active; contrary to what occurs in hot, humid places, which are essentially depressing, very liable to cause anœmia, malanœmia, loss of appetite, and make nutrition very slow, depressing the metabolism.

Coming now to the practical application deduced from the above facts and reflections, we will say that we are aided by personal experience in hot and temperate climates, and appeal to Drs. Licéaga and Breña for those of high elevation.

The state of Sonora has a good climate for individuals with a predisposition, but not hereditary. Residence ought to be prolonged for several years, and it is useful to lead an active life in the open air, to take

cold baths and alcohol in moderation. This conclusion is applicable to the north of Sinaloa, going from Culiacan to Lower California and west of Chihuahua.

Every hot and humid place is bad for this kind of people, because their constitutional debility increases; and if in truth their catahrral affections of the lungs improve, they easily contract anœmia, and if they had it, it becomes worse, as also chronic impaludism.

The temperate zone can be used as a winter station for predisposed individuals, giving the preference to the dry climate, which is also useful to those suffering from chronic bronchitis and bronchiectasis.

Tuberculosis being declared. If the person reside in the above mentioned climates his physician will do well to advise a quick change to a high country. The first hœmoptysis ought to be the signal of alarm, above all if it occurs in the spring, which is usually the case.

It is not prudent to permit this kind of persons to return quickly to a warm climate. The physician can assure them that the influence of the climate will be fatal, and therapeutic resources of insignificant value. As long as feverish reaction exists, or the slightest tendency to hœmoptysis, residence in these climates is formally forbidden, especially in those where the thermometer passes 28° in spring and summer, and there is humidity.

The sufferers from apyretic tuberculosis can pass the winter without danger in Lower California and the dry coast of Sonora; if, when the weather gets warmer, there is no sign of pulmonary hemorrhage nor febrile reaction they can still remain for the summer; there are examples of amelioration from a permanent stay by the sea-shore in a dry, warm place and again others of the reverse, according to individual idiosyncracies, or certain peculiar conditions that are not easy to determine.

Touching Zacatecas we reproduce the following conclusions, established by Dr. Breña in his excellent memorandum:

1. Phthisis is excessively rare in persons who have lived always or for many years in Zacatecas.

2. Cases of cure have been seen in the first and second stages of the disease.

3. The facts mentioned are probably due to the elevation above the level of the sea, the dryness of the atmosphere, the special manner of living of most of the inhabitants, and the non-crowding of persons in small lodgings.

4. Zacatecas is very beneficial to comsumptive persons, principally in the first stage of the illness, and in its slow, localized, and accidental forms.

5. When suppuration of the pulmonary deposits has commenced, there is less probability of deriving enough benefit from the climate to compensate the patient for trouble and pain of changing his residence. The success will depend on the amount of individual resistance and the magnitude of the wound.

6. If the softening is multiple or extensive, it is useless to move the patient.

7. The same ought to be said in cases of galloping consumption or generalized phthisis and of that which attacks old age.

8. Sudden changes of temperature and the various episodes of tuberculosis in its progress exact the vigilance of the physician, which should not be exclusively fixed on the curative influence of the climate.

9. It is impossible to fix the necessary time of residence in Zacatecas for the cure of phthisis, as it depends on the impression of the climate on the patient, as also on the form and stage of the disease.

As we see, Dr. Breña limits the beneficial influence of the climate of Zacatecas to limited cases and gives no hope for those which are far advanced or whose progress is very rapid, as in galloping consumption. I ought to mention that the commonest form I have seen on our coasts is rapid, which does not mean exactly galloping, for the typhoid and asphyxiated character that corresponds to this is not so frequent. It is necessary to have this difference well established.

What can be done with sufferers from consumption in its rapid form of our coasts? I still incline to their being moved to the valley of Mexico, being well convinced of the uselessness of all efforts in those climates. Even granulia fatal here, in reality only causes a small average of deaths in the capital of 1.6 per cent. from tubercular affections in general, and 1.2 per cent. from pulmonary phthisis.

With regard to our central table-land, principally the valley of Mexico, Dr. Licéaga has established the following conclusions which in his judgment are favorable to the cure of tuberculosis; I am perfectly in accord with him as to what corresponds to the climate, and they are added to the accompanying statistics:

"It is necessary to make consumptives live in places, impossible to the existence of bacillus of Koch or less favorable to this microbe than those where it has grown. It is necessary that the consumptive live in a pure atmosphere, and that he remain in the open air as many hours as possible in every season.

Every patient should have proper exercise, food, and dress, and for this he must be under the vigilant care of intelligent doctors.

It is indispensable to cure the lesions already produced, by every means known to science. The conditions contained in these two last propositions can be realized in establishments like those of Görbersdorf, of Talkenstein, etc.

It is possible to create similar establishments with infinitely superior climatic conditions in the great Central table-land of Anahuac."

From the adjoining statistic data we have the result that the best villages from the point of view that we take are those that give only one per cent. of the mortality from tuberculosis compared to the deaths in general, and none more fitted for the foundation of houses of health or sanitarium than Atzcapotzalco, Tlalpam, and Tepotzotlan; adding also Texcoco, which gives 1.6 per cent.

Mexicans, being accustomed to the suavity of their climate, to the imposing and majestic beauty of the mountains, to the incomparable

transparency of the atmosphere, which diffuses the rays of a tropical sun with extraordinary brilliancy, do not appreciate as they ought these advantages, nor does our spirit rejoice over the smiling perspective of our valley; but the foreigner, a native of the icy regions of the north, will receive an indelible impression of joy and well-being when he contemplates these beauties of nature, even on those days that to us seem cold but nevertheless allow the growth of flowers that adorn our fields. Not only physical health, and cruel sufferings from disease, but the moral depression that accompanies them, will be relieved, and a great and well-founded hope of recovery will spring up. In the meantime science may discover a specific treatment for this fatal illness.

I, myself, being pre-disposed to it in my youth, have had to make frequent changes of place, thus obtaining the good experience to which I have alluded, in my own person. For this reason I have chosen the theme on which I have just spoken, so interesting not only to Mexicans but to humanity in general, completing with it a thought or maxim of medical morality of the distinguished and lamented Dr. Jourdanet, who interested himself so much with the Mexican climate. *Dire ce qu' on sait et ce qu' on pense est toujours un devoir quand la santé de ses semblables s' y trouve interessé.* To say what one knows and thinks, is always a duty when the health of our fellow-beings is concerned.

STATISTICAL TABLE.

Showing the mortality by tubercular affections in the city of Mexico, embracing the period of years from January, 1879, to July, 1892, taken from official data of the Superior Council of health by Dr. A. J. Carbajal.

YEARS.	Tuberculosis meningea.	Laringea and other tuberculosis affections.	Pulmonary, acute, general, miliary.	Intestinal of the peritoneum.	TOTALS.	General mortality.	Mortality in proportion to 100 of tubercular affections.	Mortality in proportion to 100 of pulmonary tuberculosis.
1879	40	7	680	80	807	10,223	789	665
1880	35	10	668	95	808	9,455	854	700
1881	63	13	620	85	781	9,687	805	640
1882	62	8	776	116	962	11,523	834	673
1883	42	8	767	102	919	12,047	762	636
1884	46	9	824	79	958	12,083	792	690
1885	41	10	913	94	1,058	13,067	809	698
1886	81	13	900	164	1,158	13,102	883	686
1887	66	16	868	202	1,152	13,200	872	650
1888	65	8	877	204	1,154	13,218	873	656
1889	69	23	890	242	1,224	15,436	793	576
1890	55	19	1,072	205	1,351	16,590	814	646
1891	75	20	920	247	1,262	15,236	828	603
1892	47	12	509	133	701	8,708	805	584

ANNUAL AVERAGE OF DEATHS IN THIRTEEN YEARS.

Tuberculosis meningea.	56.9
Tuberculosis laringea and other tubercular affections . .	12.61
Tuberculosis pulmonary, miliary, general, acute . . .	844.2
Tuberculosis intestinal and of the peritoneum . . .	147.2
General mortality	12,684
Proportion to the 100 of the tubercular diseases . . .	8.17
Proportion to the 100 of pulmonary, miliary, general, acute, compared with the general mortality	6.99

TABLE.

Showing the average of deaths caused by tubercular disease in general, with regard to the mortality in the Federal District since July 1, 1885, to June 30, 1890, taken from the work of Dr. D. Orvañanos.

Prefecture of Tacubaya.	Natives.	Foreigners.	Total.
Tacubaya	3.11	2.40	5.51
Santa Fé	5.78	1.36	1.14
Cuajimalpa	1.70	0.56	2.26
Tacuba	1.88	0.73	2.61
Mixcoac	1.33	1.33	2.66
Prefecture of Xochimilco.			
Xochimilco	....	....	....
Milpa Alta	....	....	....
Hastehuacan	....	....	....
Tlahuac y Tlaltenango	1.01	1.07	2.08
Tulyehualco	....	....	....
Oxtotepec	....	....	....
Actopan	....	....	....
Misquic	1.01	1.07	2.08
Prefecture of Tlalpam.			
Tlalpam	0.73	0.55	1.28
San Angel	1.41	0.80	2.21
Coyoacan	1.21	0.11	1.32
Ixtapalapam	1.01	1.07	2.08
Ixtacalco	1.01	1.07	2.08
Prefecture of Guadalupe.			
La Villa de Guadalupe	2.23	1.68	3.91
Atzcapotzalco	0.86	0.37	1.23
City of Mexico.			
Mexico (the capital)	....	....	8.40
Towns in the Valley of Mexico (State of Mexico)	....	....	....
Tepotzotlan	1.0	....	1.0
Texcoco	1.60	....	1.60

TABLE.

Showing the mortality from pulmonary tuberculosis in the City of Veracruz, in the year 1887. Data taken from the work of Dr. D. Mexia, Statistics of Mortality of Veracruz.

Number of Inhabitants, 28,900.	Tuberculosis.	General mortality.	Percentage.
Deaths from pulmonary tuberculosis	223		
General mortality		1,028	
Proportion to the 100			22.66

TABLE.

Showing the mortality by tuberculosis disease in the State of Oaxaca during the six months from October, 1891, to March, 1892, with reference to the general mortality data taken from the general statistic table of diseases, published by the Secretary's Office of the State Government.

Number of Inhabitants, 822,179, Census to March 31, 1892 (comprising the mortality of the capital, villages, and suburbs, and of the 26 districts).	General mortality.	Mortality from tubercular diseases.	Percentage.
The only classification is of pulmonary tuberculosis and of mesenteric tabes	11,435	238	208

TABLE.

Showing the mortality from tubercular affections in the State of Zacatecas, from July 1 to December 31, 1890. Data taken from the memorandum of Dr. J. Breña, Studies of medical climatology of Zacatecas, 1892.

Number of Inhabitants of the State, 476,761.	General mortality.	Mortality from tuberculosis diseases.	Mortality from pulmonary tuberculosis.	Average to the 100 of all diseases.	Average to the 100 from pulmonary tuberculosis.
Pulmonary tuberculosis		40	40		
Tubercular meningitis		5			
Tubercular enteritis					
Mesenteric tabes		5			
Other tubercular diseases		46		0.92	0.37
Total	10,684	96	40	0.92	0.37

SUMMARY

Of the tables showing the mortality from Tuberculosis in relation with the general one in three classes of climate, cold or of high elevation, valley of Mexico and Zacatecas; temperate, Oaxaca; warm, damp of the coast, Veracruz, of the United States of Mexico.

Place.	Proportion to the 100 tubercular affections.	Proportion to the 100 pulmonary tuberculosis.
Zacatecas (the state)	0.92	0.37
Atzcapotzalco, Tlalpam (head town) and	.....	.....
Tepotzolan (State of Mexico) not above	1.00	.....
La Villa de Guadalupe, the towns of the districts of Tlalpam, Xochimilco, and Tacubaya, (except the following) are not above.	2.00	.....
Tacubaya and Sante Fé not above	6.00	.....
Mexico (the city)	8.17	6.59
Oaxaca (the state)	2.08	56.22
Veracruz (the city)	.....	.....

VII.

GENERAL CONSIDERATIONS ON THE IMPORTANCE OF PUBLIC HYGIENE.

By Dr. R. LAVISTA,

Mexico.

To refuse honors, which we do not deserve, is an absurdity resisted by common sense and human nature. It is almost a virtue to know oneself, and certainly most difficult of attainment.

A great honor is done me to-day, in permitting me to address this illustrious assembly, to which I have been invited in spite of my known incompetence to belong to it. Occupied, as I am, with another kind of study, to which I have consecrated my life and all my attention, I do not feel myself equal to a serious study of hygienic subjects, the exclusive object of this illustrious Association. And the idea took such hold of me, that I should have resisted it, if the wonderful power of friendship had not come to my aid, especially the friendship I owe to my esteemed friend, the distinguished president of the Mexican committee on one part, and the respect and consideration merited by the distinguished visitors, who now honour my country with their presence in this hall.

I have a debt to pay to the illustrious members of the American Association of Medicine and Surgery for the unmerited consideration of which I have been the subject on some occasions, and I pay it with the greatest pleasure, declaring that my co-professors of the great American nation are illustrious gentlemen and worthy of the place they have conquered in the scientific world. I render a just homage to the honorable occupation of the American hygienists and a sincere manifestation of the esteem that I profess for them.

In the battle of life man struggles incessantly to preserve health. This precious gift seems to be instinctively the object of his watchful care and has been so constantly, but unfurnished with knowledge to evade the powerful and numerous evil influences that surround him, he fell at each step into the precipice of his ignorance. His life, particularly and collectively, was compromised by the bad use of the means in which he lived; compromising also his natural force of resistance, the only defense against his numerous enemies.

The diseases he contracted could be combatted with more or less care, but the danger was always there, menacing his precious life. More simple and logical it would have been to think of preventing these, than only to cure them after they were declared; but, how to reach this desired end if man possessed not the adequate means?

Before public and private hygiene had been constituted a precious and inestimable talisman of his defence, he had no resource but to fight the enemy; there were no means of prevention, or he did not know how to use them. It was clearly necessary to make rules for man to live physiologically and socially.

The knowledge of the multitude of injurious springs that disturbed his health was indispensable, but it was not within his reach until illustrious medical men devoted special attention to this kind of study, constituting that most important branch of science, which now forms the firmest support and defence of man and of society.

Its beneficial influence is felt in all the actions of human life, and naturally on social life collectively. A general basis, once established, for the preservation of health, man that took care that the air he breathed, the soil he inhabited, and the food that maintained him, should possess the conditions indispensable for a healthy life, and he avoided the vices offered to him by these indispensable agents if they were not presented in the sanitary form required by his organism.

The necessary elements of life are at the same time the necessary agents of death, and how can we evade their bad influence if we cannot live without them? Hygiene, which to-day analyzes and defines their good and bad conditions, gives us the key of health and constitutes an unbreakable barrier against illness. Its apostles are the guardians of the redemption of the human species; they preach everywhere, in families, in society, and to the individual, the scientific creed that in their midnight studies has been revealed to them, by noble, generous, and divine science, which they have conquered and are divinely entrusted with.

Grand and sublime is the task of the physicians who alleviate pain and cure disease, but not less sublime and worthy of the gratitude of the human race are the hygienists, who prevent illness, preserve life, and aid the natural growth of man, and of the society to which he belongs.

These considerations thus generally treated, must be left for a more detailed study to pens more able than mine. I will limit my duty to compliment the noble assembly, who pursue the noble end of divulging the truths acquired in their studies, and who, no doubt, will reap a fruitful harvest. It is a laudable intention of congress that here the said ends should be realized and it is the duty of men of feeling to congratulate the illustrious workers, declaring that they merit the good opinion of all humanity.

VIII.

CONTRIBUTIONS TO THE BACTERIOLOGICAL STUDY OF THE DRINKING WATERS OF THE CITY OF MEXICO.

By Dr. JOSÉ RAMIREZ,

Secretary of the Supreme Board of Health, Professor of Botany in the National Medical Institute,

and

Dr. MANUEL TOUSSAINT,

Professor of Physiology in the National Medical Institute.

Mexico.

I.

SPRINGS.

The city of Mexico consumes drinking water: 1st, from the springs of Chapultepec; 2d, from the springs of Santa Fé, Los Leones y el Desierto; 3d, from the river Tlalnepantla or water of the town of Guadalupe, and 4th, from artesian wells.

SPRING OF CHAPULTEPEC.

This water, which is known under the name of hard water *(agua gorda)*, is the first which was brought into the city, and eighty years before the Conquest a special aqueduct existed for that purpose. In March, 1779, the arches and aqueduct were finally concluded, including 904 arches with a total length of 4,663 varas. The spring is situated within the forest of Chapultepec, and to the eastward of the hill it has a retaining wall of masonry which was constructed before the year 1571. With the lapse of time the level of the water has lowered considerably, and especially since artesian wells have been introduced in the neighborhood of Chapultepec. The qualities of this water are as follows: A blue color, a remarkable transparency that allows the bottom of the spring to be seen, an agreeable taste, and an average temperature of 21°. The vegetation is formed of algœ of an indetermined class.

The spring abounds in small fish and crustaceæ.

This water is in the best condition to be considered as a type of drinking-water, as on account of the piping laid down before the end of last year, the water no longer runs through the old aqueduct which was open along its entire length, and we now can say that it is free from all danger

of the contamination that it was liable to before that date. Doubtless it was for this reason that Sahagun in speaking of these waters, said that they were "bad and insufficient for the supply of the city." In fact, these waters have always run in an open conduit, receiving impurities which the wind carried from the causeways along which they ran, and forming small pools with the water which leaked from the cracks in the arches.

SPRING OF ALBERCA GRANDE.

The city council having acquired the property in this spring and prepared plans for conducting the water into the city, it will be utilized from this year. The water is elevated by means of powerful steam pumps, to a tank situated on the side of the hill of Chapultepec, to which tank will also be elevated the waters of the spring within the forest, so as to bring them altogether in the city under high pressure. The properties of these waters are the same as those of the spring above spoken of; they rise outside of the forest, and are contained in a rectangular tank measuring 17 by 13 meters, with a depth of 12 to 15. Several animals and plants live in this tank, and among the latter we have observed an abundance of *Ceratophyllum demersum*. Linn.

SPRING OF SANTA FÉ.

In the year 1576 the supply of water from the spring of Chapultepec was found to be insufficient for the requirements of the city, and the Viceroy D. Martin Enriquez granted to the city the water rising in the spring of Santa Fé. In the following century (1603–1620) the government commenced and terminated the construction of the aqueduct, which, commencing above Chapultepec, followed the causeway of La Veronica and terminated the Mariscala street. This work cost $150,000, had a length of four miles, and was formed of more than 900 masonry arches. History has given us the dates of the establishment of the partial piping of this water, and now that the iron piping has been laid as far as the Molino del Rey, the city council gave orders that the soft water should be brought through that into the city after the month of September, establishing at the same time a connection between this and the tank dedicated to the reception of the hard water, so that in case the quantity of either should be diminished for any reason, the supply to the city would not in any way suffer.

The spring of Santa Fé is situated near the village of the same name, in the midst of a small forest of pines, willows, and poplars. The water has a temperature of 14°, and the spring is situated at a distance of 9,716 meters from the city and 166 meters above it. Several kinds of plants and small animals live in the water.

The waters of Santa Fé are incorporated with those of Desierto and of Los Leones, before arriving to the place known as Casa Mata.

SPRINGS OF EL DESIERTO AND LOS LEONES.

Two centuries had elapsed and the increase of population and necessities in the city obliged the authorities to look for means of increasing the amount of water, the consequence being that they found themselves obliged to utilize the springs of Los Leones and El Desierto. This improvement was carried out in the year 1796. The waters from these springs together with those from Santa Fé, form the volume of what is known under the name of soft water *(agua delgada)*, and from them is drawn the supply for two thirds of the population. These springs rise on the two slopes of the mountain called San Miguel; they are very numerous but only produce a small quantity of water each; they have not as yet been properly fenced, and they rise in the midst of small swamps, a fact which is undoubtedly unfavorable to their purity. As far as the tank of Los Leones, the waters from the spring of that name flow in open gutters on the side of the ravine, and from there they follow their course in a masonry gutter which terminates in a wooden one, the latter carrying them to the aqueduct in which flow the waters of El Desierto. These springs rise on the eastern side of the same mountain of San Miguel, and are more abundant than the previous ones. The waters flow in open gutters similar to the last, but at a lower elevation, and they receive in their course the waters from the springs of Champilato, and Monarca, Los Capulines, etc., eventually uniting with those from Los Leones before arriving at a point called Tres Cruces. From that point the waters flow in conduits lined with brick, but open in many places. The direction of the aqueduct is to the eastward; it reaches Molino Viejo, and from thence proceeds to the settling tank of Tinacal, Molino del Rey, and terminates in the arched aqueduct that conducts the water to the city. Later on we will speak of the modifications that have been made the present year by bringing the waters from the Molino del Rey through a new iron piping, instead of bringing it by the old aqueduct on the Veronica road, thus diminishing to a considerable extent the risk of contamination in these waters.

The height of these springs over the level of the city is 900 meters, more or less.

This water has a temperature in the springs of 9° to 11°; they are slightly alkaline, transparent in the absence of rain, when they are mixed with ochrous clay which enters largely into the formation of the ground in which they rise. The places in which these springs rise have the vegetation which is natural to mountains.

WATER OF THE TOWN OF GUADALUPE.

This water comes from the neighborhood of the Tlalnepantla hills, and flows through an aqueduct three leagues long, the construction of which was commenced in 1743 and terminated in 1751. This aqueduct supplies the villages of Santa Isabel, Zacatengo, Tucamá, and the town of Gua-

dalupe. It now also supplies a small part of the city, through iron piping, which was laid along the causeway in 1882 from that town, and supplies water to those blocks situated between the Calle of Santa Ana and the Avenida de la Paz. From its chemical character, this can be classed as soft water, but unfortunately it is highly charged with sediment which it receives on the slopes of the hills.

ARTESIAN WELLS.

According to the data collected by the government of the district, there were 483 artesian wells in the city in April, 1883. As a general rule, the waters from these wells are characterized by a perfect transparency, by the absence of organic matters, when the wells reach a good depth and are well lined, and by a smell *sui generis*, due to the carbonic gas which is readily dissipated on exposure to the atmosphere.

II.

BACTERIOLOGICAL ANALYSIS OF WATERS OF CHAPULTEPEC.

During the months of June, July, and the beginning of August, that is to say, when these waters flowed through an open aqueduct, we undertook an examination of the same, taking it from the fountain in the Medical Institute. Before continuing, and in order to avoid further digression, we must observe that in all these analyses we have strictly followed the methods employed in the laboratories of Europe for the same purpose, utilizing the experience which we acquired in the Pasteur Institute when we followed the course of bacteriology which was given by M. Roux, during the months of March and April, 1890. We have also taken advantage of the resources at the disposal of the National Medical Institute, which can almost be considered as amply sufficient for researches of this class.

The water, which was collected with all the necessary precautions, was placed in Petri boxes with gelatine and agar, and these boxes were placed in a room having a maximum temperature of 23°. After many analyses, we found that on an average, each cubic centimetre of water contained from one thousand to one thousand two hundred bacteria; that is to say, that according to Miquel's list, the water from the Chapultepec spring ought to be considered as within the inferior limits of pure waters. It is to be noted that the number of micro-organisms varies from day to day, and that we have as yet to determine the circumstances which cause this variation. Thus we find very frequently that on preparing ten Petri cases, all at the same time and with water from the same flask, six or eight will remain without producing any colony, while on the following day, and with an exactly similar preparation, all the cases will be found to have fertilized, and some of them to have colonies so numerous as to be beyond counting.

These species that we have been able to isolate up to the present are

twelve, and their characteristics are those set down in the following enumeration. We have taken their denominations from the aspect which they present in the colony developed in gelatine or in agar, as we do not care to give them their specific names until we are fully convinced that they are bacteria which have not been described by other authors, as we believe the greater part of them have been.

1st. Orange colored colony which liquefies gelatine: long bacillus, with a slow movement, difficult to color. Grows rapidly in gelatine, which it melts, and is deposited at the bottom with a metallic appearance. In agar it develops slowly and the coloring matter is diffused throughout the mass. In broth, it has fair development, smells like glue, clouds the broth, and is deposited at the bottom. In potatoes, it has a very slow development and preserves its color.

2d. Solid orange colored colony. Very small micrococcus. In gelatine it has slow development, and liquefies it when inserted with a needle and delays in taking on color. In agar with a similar cultivation, it grows at a depth, taking a gray color. In broth it has a very slow development, gives forth a bad odor, and renders it turbid. In potatoes it will hardly develop.

3d. Rose colored colony. Very small micrococcus, without movement. In gelatine it grows slowly, takes on a gray color at a depth, and does not liquefy it. In agar it has similar characteristics, forming a rounded colony which projects. In broth, it has a medium development, is deposited at the bottom, and does not give out any bad odor. In potatoes, it hardly develops.

4th. Solid green colony: Micrococcus without movement. It slowly liquefies gelatine, forming a deposit with a whitish color. In agar it does not liquefy, takes on a greenish-yellow color, does not develop at the bottom, and gives forth a bad odor. In broth, it causes a turbid appearance, has a dirty looking reddish-yellow deposit that finally takes on a rose color; it has an easy development, taking on its own color.

5th. Green colony which rapidly liquefies gelatine. A short bacillus having movement. It liquefies gelatine, communicating to it a bluish-green fluorescent color. In agar, it has a rapid development, does not liquefy, the coloring matter is diffused throughout the mass; forms a projecting rounded colony and has a yellow sulphur color. In broth it develops rapidly, renders it turbid, makes an abundant deposit, communicates its own color, and has a putrid odor. In potatoes, it has a fair development with a red brick color.

6th. White colony in clots: Estreptococcus. It slowly dissolves gelatine, taking a dirty yellow color in old cultivations. In agar it develops forming clots; when sown in stripes we find small rounded colonies appearing on the side of this and at a certain distance; it does not liquefy the agar, and takes on the same color as the gelatine in old cultivations. In broth, it renders it turbid, communicating to it a green color and forming a whitish deposit at the bottom. In potatoes, it has

an easy development characteristic of itself, and forms white masses which turn to powder on the surface.

7th. White colony that rapidly liquefies gelatine. A micrococcus with a rapid vibratory movement. It liquefies gelatine as already stated. In agar, when inserted with a needle, it extends along the perforation made and on the surface, with a dirty white color which is communicated to the entire medium. In broth, it communicates a color similar to that of urine, renders it turbid, forms a scarce whitish deposit, and gives forth a bad odor. In potatoes it has a characteristic and rapid development. Forms damp abundant and projecting masses, which produce gas bubbles, raising them in certain points to the surface; these masses after a few days take on a reddish color which changes to black, and give forth a smell of sour paste.

8th. White colony: Cladotrix with very thin ramifications. In gelatine it has a very slow development, forms a tissue on the surface with white clots, dry and projecting. In potatoes it does not develop as far as our knowledge goes.

9th. Ramified white colony: Ærobius and anaecrobius bacillus. In gelatine it liquefies with a slow development. In agar it has a rapid development, with a dirty milk-white color; it sends forth ramifications which afterwards form projecting folds; sown in stripes it forms a damp milk-white colony, with small isolated colonies on the sides. In a Petri case it extends along the bottom, throwing out ramifications. In broth it has a rapid growth, renders it turbid, and forms a white deposit in the bottom. In potatoes, it extends rapidly, forming a thick layer, which is at first damp and of a dirty white color, but afterwards dries and wrinkles, forming projecting folds.

10th. White dry colony: A micrococcus. In gelatine it forms a milk-white colony appearing like a drop of that liquid; it liquefies slightly. In agar, when sown in stripes, it forms a colony with a color similar to the ramified colony but without throwing out ramifications; inserted with a needle, it extends superficially with the appearance of a drop of milk or glazed porcelain. It does not render broth turbid but forms a deposit at the bottom. In potatoes it forms a white mass which develops with a certain facility and is distinguished from the estreptococcus by the color which the latter takes in old cultivation.

11th. White transparent colony that liquefies in a funnel shape: A long bacillus. In gelatine it liquefies as stated. In agar it takes on a slightly dirty-white color, it develops at the bottom and when the cultivation is old, it takes a dirty-yellow color. In broth it develops abundantly, gives it a muddy appearance, forming a dirty-white tissue on the surface, and gives forth a bad smell. In potatoes it has a rapid development, forming a thick, damp, orange-colored layer, that in old cultivations takes on in certain points a still dirtier color.

12th. White colony, developed in broth at 45°: Micrococcus. In gelatine it develops on the surface with a white color. In agar it has a rapid development similar to the preceding. It gives broth a muddy

appearance. It does not develop in potato. Besides these bacteria we have obtained two others whose character we have not been able to study in their different mediums, and we can only observe that one of them is anaerobia and the other aerobia, the first being a micrococcus and the second a bacillus in the form of coma.

In the months of October and November, when the water was already flowing through the iron pipes, we renewed our cultivations, and the result, as may be easily supposed, was a discovery of a very diminished number of bacteria contained in a cubic centimetre of water. The average that we then obtained was from 400 to 500. This decided diminution is due to two circumstances: first, that the water flows through closed pipes and can only be contaminated in the spring or in the tank, and second, that the present temperature is lower than at the time of our first experiment. Next year when we repeat our experiments under the same conditions with respect to temperature, we will know what share of this diminution belongs to each of these factors. With respect to the frequency with which the species obtained has appeared in this new series of cultivations, we can note that there has been a considerable diminution in that which produces orange-colored colonies that liquify the gelatine, the green colony that produces the same phenomenon and the cladotrix, and that in exchange we more frequently meet the white colony which liquifies gelatine in the shape of a funnel.

In concluding this part relative to the bacteriological studies, we can state that from the cultivations that we have made of the atmospheric organisms, we have come to the conclusion that the greater part of those contained in the water proceed from the air. In fact, we only require to expose a Petri case with sterilized gelatine to contact with the atmosphere for one or two minutes, to obtain colonies which are identical with those produced by cultivation from water.

SOFT WATER.

The experiments on this water were carried out in the months of October and November, drawing it from the fountain in a house situated in the Rinconada de San Diego. We found an average of 750 bacteria per cubic centimetre of water, and it was probably on account of the low temperature of those days, that we found the colonies predominating to be numbers 2, 3, 5, and 7 of those which were enumerated in treating of the hard water.

As we have before said, these studies are as yet very incomplete, but we propose to continue them through the year 1893. For this purpose we will take water from the springs themselves, and from different parts of the aqueducts, so as to be able to calculate the quantity of bacteria which they collected in their course; besides this, we have the intention of completing the experiments by a bacteriological study of the air.

III.

In undertaking the present study, our intention was, once we had isolated these bacteria, to inoculate animals with their cultivations so as to determine their pathogenic action; but circumstances to which it is needless to refer, prevented our carrying out these experiments and the small number of observations which we were able to make do not justify us in coming to any conclusion. The point that we desired to determine, was to prove by actual experiments the theory that has been formed by several physicians, who suppose that the drinking waters of the city are the cause of the diseases of the digestive tube which every year carry off so many victims in this capital. It cannot be doubted that the above theory can only be proved or disproved by data discovered through careful experiments. Nevertheless, with the advances which have been made in bacteriological studies of water and by the results obtained in the numerous examinations made in other countries on the same subject, we can form a few conclusions which go a long way towards diminishing the probability for the theory under discussion. Indeed, the symptoms which up to this date have been attributed to the influence of bacteria proper to drinking water are not those which we observe in simple, acute, or chronic inflammation of the digestive tube. It is certain that many authors attribute sporadic cholera to micro-organisms which are developed and live in water, but it is also admitted that the cause of the disease is due to bacteria which normally live in the intestines. But we will put this question aside; in the first place, because at this moment it is of no importance to ourselves, seeing that the cholera nostras is not more frequent here than in other parts, and in the second place, because this point is not as yet sufficiently cleared up and its discussion would carry us out of the limits of the present paper. We do not deny the possibility of the transmission of certain diseases of the digestive tube by means of drinking water, but we only suppose it very improbable that the bacteria found in the entercolitis which are observed here, should be those which we have found in the waters drunk in the city. Neither do we ignore that true dysentery is supposed to be produced by amœbæ, but we can only repeat that we have limited our present study to a search for the cause of simple inflammation of the digestive tube.

On the other hand, there are facts that may be called indirect which strengthen our assertion; we allude to the modifications which from time to time have been made in the distribution of the water, and which undoubtedly have improved its qualities. The iron piping was established in 1883–1884, substituting the old lead piping, which by frequent deterioration permitted the contamination of the water with that from the drains, sewers, and subsoil. With this improvement all the causes of water pollution disappeared within the city, but by way of increasing the precautions, the city council in 1887 gave orders for covering a considerable length of the aqueduct, at the place called Los Cedros and in other parts of its length.

After the carrying out of these improvements, it would have been natural, if this theory were true, that the average deaths from diseases of the digestive tube should have suffered a proportionate diminution, but the statistics which accompany this paper show that the mortality has remained proportionally the same. (See the accompanying tables.)

These undeniable facts show that there is no probability in the theory that we dispute. On the other hand, we have many other reliable data which justify the ideas enunciated, and these data are so well known that there is no necessity for our publishing the figures, as it is enough to form the curve of the preceding statistics, to be convinced that one of the principal causes of the mortality should be attributed to that complex group of meteorological circumstances which are known under the name of *seasonable causes;* and, in fact, observation has demonstrated that humidity, heat, and sudden changes of temperature are the conditions which favor the development of intestinal inflammations. In Mexico, the temperature rises during the months of March, April, May, and June; during the last month the rainy season commences and simultaneously with that rises the curve of mortality through the diseases we are treating of; in November, December, and January, the temperature lowers, the hygrometric condition is at its lowest, and the curve of mortality lowers considerably in January, February, and March. To these different causes we ought to add another of the greatest interest; the insufficient food which is taken by the poorer class and even by the majority of the middle class; the abuse of tortillas, chilli, and pulque, as well as of the half-ripe fruits, and the insufficiency of food containing azoe, are facts perfectly well known to everybody, and which also explain the weak constitution which we find general among the inhabitants of the city. In conclusion we may say,—

1st. That the causes are various which determine and favor the acute or chronic inflammations of the digestive tube, and which produce a considerable mortality in Mexico City.

2d. That among these causes we ought to consider as principal ones, the inadequate alimentation and the special climatological conditions of the locality.

TABLE.

Showing the Mortality in Mexico City during the years 1878 to 1891 inclusive, from gastritis, gastro-enteritis, enteritis, entero-colitis, cholera infantum, and sporadic cholera, compiled from data in the archives of the Statistical Department of the Supreme Board of Health.

YEARS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Totals.	General mortality.
1878 .	79	58	73	102	118	191	208	177	169	191	135	128	1,629	10,164
1879 .	120	123	147	156	207	224	329	294	191	190	163	124	2,268	10,223
1880 .	103	83	129	167	222	183	246	236	144	124	144	131	1,912	9,455
1881 .	95	92	120	143	184	216	229	224	212	170	147	148	1,980	9,687
1882 .	87	95	156	298	417	326	351	240	183	164	134	119	2,570	11,523
1883 .	93	99	137	273	312	318	284	249	190	206	169	195	2,525	12,047
1884 .	128	123	183	244	259	328	274	347	297	305	210	176	2,874	12,803
1885 .	149	134	185	262	310	419	320	222	238	238	213	179	2,869	13,067
1886 .	164	134	181	230	237	200	345	309	250	266	256	213	2,785	13,102
1887 .	133	136	223	237	326	305	280	234	188	165	172	148	2,547	13,200
1888 .	147	134	158	214	230	264	241	255	263	206	236	196	2,544	13,221
1889 .	164	169	205	237	295	350	336	291	278	312	246	176	3,059	15,436
1890 .	208	161	201	262	327	349	398	376	263	260	165	176	3,146	16,590
1891 .	154	125	186	239	265	338	361	290	256	250	202	171	2,837	15,236
Totals.	1,824	1,666	2,284	3,064	3,709	4,011	4,202	3,744	3,122	3,047	2,592	2,280	35,545	175,754

TABLE.

Showing the Mortality in Mexico City during the year 1891, from the diseases therein enumerated, and which will serve as a basis with which to compare the preceding table.

DISEASES.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Totals.
Gastritis	2	1	4	4	2	1	2	5	4	3	3	1	32
Gastro-enteritis	12	25	25	27	34	38	46	28	18	20	28	25	326
Enteritis, colitis, and entero-colitis	138	95	154	197	219	286	310	253	230	225	168	143	2,418
Cholera infantum	2	4	2	9	8	12	0	4	3	2	2	2	50
Sporadic cholera	0	0	1	2	2	1	3	0	1	0	1	0	11
Total	154	125	186	239	265	338	361	290	256	250	202	171	2,837
General mortality . .	1,343	1,137	1,327	1,471	1,715	1,381	1,258	1,106	1,051	1,112	1,116	1,219	15,236

IX.

ZACATECAS AS A SANITARY STATION FOR PHTHISICAL PATIENTS.

By J. BREÑA, M. D.,

Zacatecas, Mex.

Of the many varied forms of treatment that have from time to time been in vogue for phthisical patients, none has received wider attention, or has gained credit *with greater justice*, than the climatic.—*The Lancet*, August 8, 1891.

The attention that has latterly been given to the treatment of tuberculosis, and the vain endeavors to find the means of quickly neutralizing the bacillus infection in the centre of the system, make it now more than ever interesting to know the places in the globe that possess the greatest advantages as sanitaria for consumptive patients. Zacatecas, the place of my residence since the year 1874, is one of those privileged regions, not only because the disease is almost unknown among the natives, but also because the morbid process goes on with benignity and slowness in persons who come, already affected, from other places. It cannot be said that the system resists advantageously *in toto* the invasion and proliferation of the bacillus of Koch, seeing that tuberculosis hydrocephalus is common enough among us, and many are the children that succumb to it, and articular, osseous, and strumous ganglionic diseases are not uncommon. It seems that immunity refers exclusively to the pulmonary locality of the tubercle. The opinion expressed by Jourdanet, and afterwards generally accepted, respecting the infrequency of consumption at great heights above the level of the sea, receives full confirmation in all concerning Zacatecas, which, as is well known, is situated at 2,496 metres above the ocean. In my opinion, to this circumstance and to the habitual dryness of the air ought to be attributed the said peculiarity, for it is a known fact that consumption and chronic complaints generally are more frequent when there is a great quantity of watery vapor in the atmosphere.

In all my practice I have only seen one case of evident death from pulmonary phthisis among the best class of people born here, and even in this case it must be mentioned that not all the time of illness was passed in Zacatecas, for the patient, who was known and treated by other physicians, was removed to Guadalajara and Leon in search of better health. A person is actually now living in this state who was clearly suffering from tuberculosis, having already touched the suppurative fusion, with night fevers, sweats, emaciation, and subclavicular, physical symptoms of softening. This case was also examined by other colleagues, and it is worthy of note that in spite of previous delicate health and other unfavorable conditions, the re-establishment was rapid and complete. As this is a

case of an intelligent, well educated person, I doubt not it would be highly instructive and convincing to obtain the data of this truly surprising example of the effect of the climatic influence and perseverance in a rational and strictly hygienic method. Convalescences from serious pyrexiæ, prolonged lactations and suppurations, numerous gestations, long dyspeptic sufferings, and other causes analogous to lowness of diet, are well known to be propitious and favorable to the appearance and growth of tubercular phthisis in the most diverse latitudes. Not one of these factors of vital decadence is missing in our city, but, notwithstanding, no doctor who knows the locality has any fear of seeing tuberculosis appear under these conditions, because the experience of every day shows the extraordinary infrequency of the said complaint among us. It would be offending the notorious lucidity of criticism that characterizes the members of the Association, to insist that neither in all the forms, nor in all the stages, of consumption is it possible of cure and improvement in Zacatecas. The slow form so common in Northern races, and in individuals of strumous and lymphatic temperament, is manifestly and favorably influenced by a stimulating, bright air; for which reason this form is best treated in the climate of Zacatecas.

The period most desirable for the removal of patients to our city is, of course, the first of those that constitute the various phases of the disease, and which, besides, is the only one that can inspire well founded hope of recovery *in integrum* of the structure of the lung to the physiological state—that is to say, when the wounds are small and few and have not yet greatly softened the viscera. If there is a cavity, and, above all, if it is extensive; if the wounds are numerous, as happens in what is called general phthisis; if the progress of the illness is very rapid, as in what is called galloping consumption, so common in young people; if the digestive organs have already suffered and the functions necessary to chylification are profoundly disturbed, and with more reason if other visceral complications are added to aggravate the situation;—neither the climate of Zacatecas nor any other is able to bring improvement, and therefore it is useless to make the patient travel. The climate here is rather cold, notably dry, and the air thin on account of the elevation. Consequently Zacatecas can be classified as one of the proper stations to benefit and stimulate the system. Observation teaches us that living in the open air in this city is favorable to re-animate vitality that is declining either from tuberculosis or any other cause of profound depression of natural force; I have worked with this idea in the incipient cases of pulmonary indurations that we have seen cured here with comparative facility, and for this same corroborating quality of climate I present and recommend it to the attention of the American Association, which is engaged in studying public health in the New Continent. Chronic pneumonia of a consumptive character, so fatal in other places, is extremely rare here, and when it appears does not always end in death. The result in most cases is recovery, especially when the patients are young. This is a well known fact to all the doctors who have practised for some years here.

In these times of adventurous assertions, of brilliant and almost fantastic promises, which from time to time agitate the medical world, and seduce even the most severe spirits, no one should be believed with only his own word as a guaranty; for this reason, in the memorandum on this question that I have presented to the National Academy of Medicine, I have strengthened the result of my experience with two kinds of proofs:

1. The first consists in the unanimous testimony of the most conspicuous and reliable doctors, who have lived in this capital for several years and practise in all grades of society. In the memorandum I presented to the Academy a letter that I directed in February, 1889, to Mr. J. Sullivan can be read, giving some data on the special qualities of this climate from a medical point of view. That document was corroborated by the opinions of Drs. J. Torres, J. M. Prevost, Felix Ponce, Yesi, E. Lancing, and R. J. Torres, all professors who have, for a long time, enjoyed a solid medical reputation and great popularity and fame in their large practice. All these persons agree with me in asserting that pulmonary phthisis is extraordinarily rare in this city, does not attack people born, or residing many years, in Zacatecas, and they have all witnessed various cases of recovery in patients coming from other places, who were already in the first stage of consumption. This proof is, in my opinion, plain and conclusive, considering the honor and ability of the said doctors, their long practice, and the opportunities they have had of studying the question in all grades and conditions of society.

2. The second kind of proof consists in the statistical figures resulting from official documents included in my said work. By them can be seen that in the only hospital of which Zacatecas can boast for a population of 54,000 inhabitants, according to the recent approximate calculation, and during the years 1886 and 1887, in an ingress of 4,808 patients suffering from different complaints, there were only 61 of both sexes with tuberculosis, of whom 36 came out cured or improved and 25 died. It must also be noticed that Zacatecas being a mining centre, a great part of its population is floating and many of the consumptive patients who come to the hospital have brought the illness from a distance and are natives of different parts of the Republic.

In these last years we have seen many and various methods claim public attention, the respective authors of which gift them with an efficacy against pulmonary consumption little less than infallible. Some of these medicines have had the royal merit of being as inoffensive to the patient as they are useless to destroy the bacillus. Others have been more or less injurious to the vital energy of the patient, without giving proof, by this, of more power against the supposed factor in tubercular infection, and lastly, the most famous, those surrounded by the most flattering promises have shown once more the preponderating influence that ought to be given in lectures to the results of the observation of those purely animated by systematic ideas. The confidence, inspired for a moment by that diversity of therapeutic eccentricities, has disappeared, and an immense majority of doctors are agreed with Dr. L. Barlow in the words

that serve as a motto to this short review. For this reason I have resolved to claim the attention of this respected corporation on the qualities of the climate of Zacatecas with respect to tubercular consumption. The fact of this pest being so exceptional in this region will some day be recognized and appreciated by all the world, and then suffering humanity will reap the consequent benefit. For the present I content myself with hoping that the eminent physicians here present will take note of the fact represented by the most notable climatological quality in this part of Mexican territory, and will be pleased to submit it some time to the criterion of their intelligent observation.

He who writes this will, in the meantime, make his weak voice heard until he is listened to and brings convictions on a matter of such vital importance. No one who finds himself in the possession of a truth advantageous to those who suffer has the right of keeping it hidden, and even if to diffuse and make all men partakers of the fruits it is necessary to overcome difficulties made by incredulity and indifference, to sustain and persevere in the struggle is an unavoidable duty, and I shall endeavor to comply with it, following the advice contained in the following phrases of the illustrious Luinet:

"Et si les avertissements ne servent à rien ; si les cœurs se sont endurcis, si les oreilles se sont fermées ? Recommencer comme si rien n'avait été dit, etouffer ses dégouts, compter sur la nature humaine, sur ses retours, sur sa force de renaissance et de vitalité. Je le veux bien. Subsissons donc le supplice de demontrer pour la centième fois l'evidence."

SUMMARY

Of the Meteorological Observations, taken at the Observatory of the Literary Institute during the year 1889 by the Astronomer, Antonio Dorantes, and the Directing Engineer, José A. y Bonilla.

LAT. N. 22° 46′ 34″ 9. LONG. W. OF MEXICO, 13′ 64″ 24. ALTITUDE, 2,496 metres.

METEOROLOGICAL ELEMENTS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Synopsis.	
Barometer, at 0° (mean)	571 91	573 70	572 24	573 69	574 52	574 73	575 28	574 97	573 71	575 49	574 30	575 16	Mean of the year	574 14
Do. absolute maximum	578 18	576 71	576 06	578 18	577 81	577 51	577 54	577 62	577 71	578 17	576 60	577 77	Maximum	578 18
Do. do. minimum	570 14	570 07	570 02	570 40	572 09	572 51	572 78	572 60	571 79	572 42	571 15	571 60	Minimum	570 02
Temperature (mean)	9° 0	11° 10	19° 90	16° 80	19° 60	20° 20	17° 60	17° 30	17° 10	16° 00	14° 40	12° 10	Meanoftheyear	15° 20
Absolute maximum (open air)	25 20	22 00	23 90	29 00	29 80	30 50	28 40	27 20	26 50	26 40	25 30	23 00	Maximum	36 50
Absolute minimum (open air)	5 00	0 80	1 50	5 50	5 00	8 00	7 20	7 00	8 30	2 70	1 00	0 40	Minimum	5 00
Daily average maximum	17 60	18 00	19 00	23 80	27 40	27 40	24 80	23 40	23 30	22 60	22 00	20 50	Maximum	27 40
Do. do. minimum	1 70	4 30	3 80	7 80	9 10	9 10	8 50	8 80	9 40	6 50	5 40	3 30	Minimum	1 70
Do. maximum oscillation	24 50	19 40	22 30	20 00	22 50	21 00	19 50	18 60	16 50	19 20	19 80	21 70	Maximum	24 50
Do. minimum do.	6 00	7 00	5 60	10 00	15 00	12 50	10 30	8 50	10 40	12 50	14 30	14 00	Minimum	5 00
Do. average do.	15 30	13 90	15 20	16 00	18 30	17 50	15 80	14 50	13 80	16 10	16 60	17 20	Mean of the year	15 80

Absolute oscillation .	20 20	21 20	22 40	23 50	24 80	22 50	21 20	20 20	18 20	23 70	24 30	22 60	Absolute maximum . . .	24 80
Moisture of the air .	70	66	59	55	53	59	65	74	78	63	58	59	Mean of the year	63
Tension of steam . .	6 56	6 84	6 61	8 27	9 44	11 10	10 63	11 36	11 93	8 92	7 33	6 60	Mean of the year	8 81
No. of days of rain .	10	6	7	4	2	14	14	12	16	3	3	1	Total in the year	92
Height of water collected in the month	68 40	12 50	42 80	8 50	13 20	102 80	77 90	130 50	85 50	9 40	7 50	3 90	Total in the year	562 90
Maximum height collected in 24 hours	24 20	11 00	13 00	6 00	7 90	27 60	18 30	31 50	22 90	5 60	7 50	3 90	Maximum . .	31° 50
Average quantity of clouds	6 00	6 10	3 10	4 00	3 40	6 10	5 70	7 00	7 20	3 10	3 90	3 10	Mean of the year	4 80
Their dominant direction	S. W.	S. W.	S. W.	S. W.	S. W.	S. E.	S. E.	S. E.	S. E.	E.	S. W.	S. W.	Dominant from the	S. W.
No. of clouded days	13	15	5	6	3	7	10	14	15	3	2	3	Total in the year	96
No. of clear days . .	7	8	21	10	14	2	6	2	3	18	9	17	Total in the year	117
Dominant wind from	S. W.	S. W.	S. W.	W.	S. W.	S. E.	E.	N. E.	S. E.	N. E.	S. W.	N. E.	Dominant from the	S. W.
Maximum velocity per second	13 70	11 60	21 00	9 00	10 00	14 20	11 00	15 20	7 80	8 70	7 50	8 00	Maximum . .	21° 00
Average velocity per second	4 50	2 20	3 00	3 00	2 40	2 80	3 40	3 10	2 10	2 80	3 00	2 50	Mean of the year	2 90
Definitions	137	125	144	144	261	260	269	205	163	123	158	150	Total in the year	2 176

X.

NOTES ON CROUP IN THE CITY OF MEXICO, AND PROPHYLACTIC MEASURES AGAINST ITS GROWTH.

By J. R. DE ARELLANO, M. D.

Mexico.

In undertaking the study of croup, and especially that of its prophylaxis, which is the theme and topic of this short paper, it is necessary first to advise that, without having the remotest intention of joining the debate that has been sustained for some time back on the etiology of diphtheria, or much less to decide whether the etiological unity agrees with the anatomic identity, and without trying to establish a landmark in the field of discussion already sufficiently confused, especially in the German school, I declare that for my part, on referring to diphtheria and croup, I do so exclusively to the *infectious*, *specific* disease, which preferably attacks children, and which is characterized by the presence of false membranes, that usually invade the amygdalas and the uvula (laryngeal diphtheria), or perhaps they place themselves in different sections of the respiratory wind-pipe, especially in the larynx, constituting, then, the true croup, or, in other words, laryngeal diphtheria.

The historic notes relating to diphtheria date back to remote epochs. In the time of Pythagoras—that is to say, 592 years before the Christian era—the Indian physician, D' Hanvantare, spoke of an incurable disease that affected the throat, obstructing the aerial canals and accompanied by febrile symptoms, and which was, according to him, due to a combination of the lymph and blood.

Areteus of Cappadocia, in the year 50 after the birth of Jesus Christ, drew with a masterly hand the symptomatic table of diphtheria and croup, and Galen, in the second century, already spoke of pseudo-membraneous expectoration, noting that if these fragments were expelled by coughing the affectation was of the larynx, and if they were thrown out by simple expectoration then the illness was localized in the pharynx.

Coelius Aurelianus, treating of the hoarse and opaque sound of the voice and even its complete extinction, also makes reference to noisy respiration, to the livid appearance of the face, and to the expulsion of aliment through the nose. According to him, Asclepiades, who had made some observations on malignant quinsy, indicated from that time something about tracheotomy.

In the Talmud the word *askara* is often found applied to a disastrous epidemic, which reigned from the second to the fourth century, and which, from the character assigned to it, could have been no other than diphtheria.

Baronius treats of the epidemics that desolated Rome in the years 856 and 1004; Franck de Wörd tells of one that invaded Germany in 1517; Gutierrez de Angulo, who died in 1522, produced many writings in vain on quinsy, which proves that such an illness existed in Spain at the beginning of the sixteenth century; and Middleton, with a collection of data, relates the chronicles of the epidemics that invaded New York in the years 1752 and 1755.[1]

Homme, the noted Scotch physician, wrote a brilliant study on croup in 1765, and on the appearance of his work, the distinction was made between simple, inflammatory croup and diphtheric croup. But, in spite of the long series of studies undertaken in previous centuries, croup has only been well studied in the present century, in which Bretonneau, Blanche, Guerssant, and Trousseau have proclaimed and brilliantly sustained the specific character of the disease. To this group of illustrious men succeeded others, who, with the greatest enthusiasm, consecrated themselves to the parasitic study of the illness, among them being Jodin, Buhl, Talamon, Tommasi, Eberth, and Letzerich.

In spite of this, Klebs was the first to point out, in 1883, a special bacillus of diphtheria, and a little later, in 1884, Löffler succeeded in isolating and keeping up this bacillus, reproducing by inoculation the false membranes in pigeons, chickens, and rabbits. But the glory of giving an enviable epilogue to such a laborious work was reserved for Roux and Yersin, who were able to show clearly and satisfactorily the active part taken by the only agent in diphtheria, the bacillus of Klebs, thus bringing to light the pathogeny of this illness, so obscure and confused until then.[2]

The history of diphtheria and croup roughly sketched, and before referring to the microbic character of both affections, which differ only in point of locality of the false membranes, to deduce afterwards from its own etiology the more treated prophylaxis, let us pass in review the data and reasons that authorize us to suppose that croup was entirely unknown in Mexico until the unfortunate epoch of the French intervention, when it was imported by their soldiers in the same way that the plague of small-pox was introduced into this country by the Spaniards in the terrible days of the conquest.

Therefore, it appears most strange that, before the year 1863, no medical writing or communication, made to the national, scientific bodies, treated of croup; and it is also noticeable that, treating of such a terrible illness, which justly inspires the greatest terror in families, as much for its excessive danger as for its marked contagious character—it is noticeable, I repeat, that not the slightest official or statistical data exist, either in the special government offices or in the archives or newspapers of our medical societies; and to this very significant silence must be added, that after that epoch communications abounded from distinguished professors on the first cases that came under their observation.

[1] Francotte: La diphtérie.

[2] Thoinot: Precis de Microbie.

Of this nature were the communications made before the Academy of Medicine of Mexico, by Drs. Iglesias and Rodriguez among others, for the years 1866 and 1871.

Dr. Lobato, in an extensive study presented to the said academy in 1872, affirmed that in the state of Guanajuato, where he then practised until 1865, laryngeal diphtheria was known to the doctors resident there only from the tables given by European authors, and that its definite introduction took place when the French invasion was at its height, owing principally to the continual arrival of French troops.

In 1874, Dr. Augustin Andrade, who possessed profound learning and was of a grave and severe character, in fact a perfect type of honor and loyalty, on referring to the academy to a case of croup, observed in his immense practice, said,—"As is well known, the croup of children appears to have been recently imported into Mexico, and although from day to day cases of this illness multiply, yet it is still rare, more rare in adults, and most rare in old people."[1]

The eminent Dr. Lucio, who, with legitimate pride, can be cited as a stamp of honor to the National School of Medicine, said that, together with the no less distinguished Dr. Miguel Jimenez, he had been able to observe at that time one of the first cases of croup that had been known in the city of Mexico, and in his wise and correct oral lectures given in his capacity of professor of pathology of the School of Medicine, he frequently stated that before the year 1865, croup was entirely unknown here.[2]

Lately, Dr. José P. Gayon, in his lecture presented to the concourse invoked by the Academy of Medicine, referring to diphtheria, says,—"I have thought it advisable to make this short summary on account of the disease being so interesting in many ways, and since 1862, *when it came into the country with the French invasion*, it has been naturalized amongst us, as is proved by the deaths it causes and which are registered every year."

The history of diphtheria, faithfully traced since it came to us, shows that, in truth, deaths caused by it are registered every year, but it also shows that in this capital it has never caused such ravages as in most capitals of Europe and the United States, and that, at least until now, it has not assumed the epidemic character that has repeatedly desolated so many places in both continents.

To demonstrate the first point we will have recourse to the inflexible logic of figures, supplied by the statistical data of other nations, comparing them at the same time with ours.

Taking the same year, that of 1883, for the capitals of Europe and the United States of America, we find in the *Demographic Statistical and Medical Summary*, by Dr. Janssens, whose claim in questions relating

[1] Gaceta Médica: Tomos del 1° al 20°.

[2] Lecciones orales del Profesor de Higiene en la Escuela Nacional de Medicina, Curso de 1892.

to hygiene is above all praise, the following data on the mortality occasioned by diphtheria and croup combined:

Brussels	158	Naples	364
London	1,776	St. Petersburg	1,232
Paris	1,916	Madrid	1,072
Berlin	2,917	New York	910
		Philadelphia	1,487

In Mexico, 60, according to statistical data published by the Superior Board of Health.

For more clearness, and again using the data of Dr. Janssens, let us see the mortality from diphtheria in relation to the number of inhabitants.

The figures on the population of each capital we have taken from the Text and Universal Atlas of Zerolo, edition of 1891.

Capitals.	Number of inhabitants.	Deaths.	Died from every 10,000 inhabitants.
Brussels	190,000	158	8.31
London	4,352,900	1,776	4.08
Paris	2,500,000	1,916	7.66
Berlin	1,574,500	2,917	18.52
St. Petersburg	1,000,000	1,232	12.30
Madrid	482,000	1,070	22.21
Naples	517,000	364	7.04
New York	1,628,000	910	5.59
Philadelphia	1,050,000	1,487	14.16
Mexico	330,000	60	1.87

Not wishing to limit to one year the proof of what we have asserted on the non-epidemic character of diphtheria in the city of Mexico, we will amplify the statistical data to a period of ten years, and by the following figures it will be seen that we are justified in our assertion.[1]

DEATHS FROM DIPHTHERIA AND CROUP.

In 1869	29	In 1874	58	Total 586.
In 1870	59	In 1875	50	
In 1871	48	In 1876	72	
In 1872	54	In 1877	80	
In 1873	56	In 1878	100	

[1] Memoria del Dr. Demetrio Mejía. Año de 1879.

In Paris, in the same period of time, according to statistics by Ernest Besnier, the number of deaths amounted to 16,290.

Supposing, then, that Mexico, like Paris, had 2,500,000 inhabitants, the mortality would have been 4,439—that is to say, the result in favor of the inhabitants of Mexico would have been the considerable number of 11,851 individuals.

As is perfectly well known, age is no safeguard against diphtheria. Washington, the illustrious liberator of the United States of the North, died from croup at the age of 68 years; the martyrdom of foreign doctors, victims to their fidelity to professional duty, is frequent, counting in this number the eminent physician, Valleix.

Fortunately the same does not happen with us, owing to the infrequency of croup in adults.

In five years—from 1881 to 1885—in Mexico, according to data of sex and age, only six adults died, divided in the following manner:

	Men.	Women.	
In 1881	0	1	3 men.
In 1882	1	0	
In 1883	0	0	
In 1884	2	1	3 women.
In 1885	0	1	

With regard to the mortality in reference to age, the largest number is embraced between the ages of 1 and 7; with reference to sex, there is very little difference; and as to seasons of the year, we will say that there are more cases in spring, and next in winter, being the same rate in summer and autumn.

Calculating, therefore, with due impartiality from the data referring to the increase of diphtheria in Mexico, we cannot but declare with certain justifiable pride that, if the statistics of deaths from typhus are terribly discouraging, those from tuberculosis, on the contrary, are far from being so fatal as in several of the European capitals, and the data concerning diphtheria and croup can be called flattering.

Considering the not far distant importation of this illness, and that in Mexico it shows no tendency to an epidemic form, that it is mild and rare in adults and that it has not reached the terrible force that it acquires in other countries, it is not over venturesome to suppose that with rigorous preventive measures, energetically carried out, this terrible disease could be, if not altogether extinguished, at least made so rare that its victims would be few.

To this end tend the final conclusions we are about to make, after giving a rapid glance over the theories that to-day reign, under a microbiological point of view without reference to diphtheria. To-day, as a positive result of the fine and admirable works of Messrs. Roux and Yersin, we are in possession of a most important series of data, which by conscientious and rigorous proofs and experiments have been elevated to the position of scientific axioms. These two clever experimentalists

have proved that the bacillus of diphtheria is only found in false membranes, and never in the organs or the blood; they have succeeded, besides, in reproducing false membranes and provoking characteristic paralysis in animals, and what is still more conclusive, they have evidenced the diphtheritic poison and proved that when this is injected alone, without the living microbes, the animals die quickly from intoxication. This poison, which Thoinot says they have succeeded in making tangible by means of their filtered breeds in porcelain after the liquids have been seven days in the oven, is the cause of rapid death in infectious cases, and is also the principal factor in immediate or late diphtheritic paralysis. In their numerous proofs, these distinguished micro-biologists have shown that it is not by generalized pollution that the bacillus works on the organism, for it remains exclusively placed in the false membranes, and consequently its action is from a distance, from poisonous secretion, or, in one word, from poison.

Elaborating this class of studies, Gamaleia, in his recent work on bacterium poisons, affirms also that from the moment that the pathogenic agent is seen in certain illnesses like cholera and diphtheria it becomes accentuated in one point of the organism, and in spite of this produces a general affection of the system; it must be agreed that this action can only be explained by the intoxication originated by the septical production of the bacillus. From the study, to which he consecrates himself, of chemical poisons produced by microbes, he infers that to-day it is possible to obtain a sure and inoffensive vaccine without the intervention of living bacteria, and that the refractory state can be attributed with only the soluble products of the microbes.

Frankel and Bering, seduced by this theory, are at present dedicating themselves, with laudable enthusiasm, to find the vaccine for diphtheria, sterilizing the diphtheric development to 70°, or mixing it with trichlorate of iodine, which proceeding has already given some positive results in the hands of Zimmer. It is for the future to decide to what success the scientific attempts of these eminent physicians will lead.

But in the meantime, while we cannot count on a sure method of vaccine, considering the infectious and contagious nature of diphtheria and croup, its prevention ought to be deduced from its etiology, confining ourselves for the present with the general precepts pointed out by hygiene for this kind of illness.

In the following notes, with which I conclude this imperfect study, some are those proposed by Dr. Roux to the International Medical Congress of Berlin, others have been pointed out by the board of health to the medical sanitary inspectors, and some I have added because I consider them of some use.

CONCLUSIONS.

1. In order to avoid as much as possible the propagation of diphtheria, an examination ought always to be made, for it is important to fix the diagnosis rapidly and precisely.

2. The patient must be completely isolated, and on no account must any one be allowed to come near him besides the persons engaged in his assistance. If there are other children in the house, they should be removed without loss of time.

3. As these children may have already contracted the germ of the disease, they must be continually watched, and not permitted to attend school, so that they may not be the means of spreading the illness.

4. At the entrance of any house where there is a patient suffering from diphtheria, a small red flag should be placed, to serve as a sign of danger,—to warn mothers not to allow their children to enter, and at the same time to show other persons the danger they run of carrying the germ to their families; and if it is absolutely necessary for any one to enter they must submit to the following preventive conditions:

5. Every person who visits a diphtheritic patient should change his dress before coming into contact with other children, and take great care to disinfect his face and hands.

6. The persons assisting the patient must try not to have him in their arms, and in the paroxysms of coughing they must avoid receiving on their face or hands any of the false membranes or secretions that are thrown out. Scratches, cuts, or any part with the skin off, must be especially kept from such contact.

7. Coaches, hand chairs, or any other piece of furniture that is used to carry the patient must be disinfected, and with much more reason should the rooms in which patients have been be subjected to a most scrupulous disinfection.

8. The articles used in examining the throat of the patient, those used for his food, china, glass, metal, etc., all must be disinfected daily in boiling water with bicarbonate of soda.

9. Any sponges or rags used for cleaning the mouth or other purposes must be burnt at once.

10. All clothes used by the patient must be submerged in a solution of carbolic acid of 2 per cent. while they are in the sick-room, whence they must be taken to the disinfecting stove, into which must also be put the mattresses, sheets, pillows, blankets, or anything else that has been used during the sickness.

11. On sweeping the room of the patient, care must be taken to first sprinkle the floor with a solution of bichlorate of mercury of 1 : 1000, to raise as little dust as possible, and to throw this into the fire.

12. The child who recovers must on no account come in contact with other children, nor go to school or any other point of reunion until a period of time has passed, not less than forty days.

13. In hospitals for children there should be a ward specially for diphtheria, in order to establish a collective isolation, and the personal physician should be provided with the proper dress for his visits, and with all necessary means for the cleanliness of his person and the disinfection of his clothes.

XI.

ETIOLOGY AND PROPHYLAXIS OF EXANTHEMATIC TYPHUS.

By NICOLAS R. DE ARELLANO, M. D.,

Professor of Medical Jurisprudence in the National School of Medicine, Member of the Superior Sanitary Council and of the National Academy of Medicine, Etc.

Mexico.

There is no doubt that the prophylaxis of any infectious, contagious disease cannot be established on a safe basis, until the micro-organism that produces it has been discovered and its conditions of existence, and its natural means of culture and propagation have been studied. Hence the importance in hygiene of the bacteriological studies and discoveries that contribute that hygienic applications should begin to lose their more or less empirical character, to be fully replaced by the scientific ones, to which it is entitled. Unfortunately, even at the present, there are yet some diseases about which the discoveries just mentioned are null or incomplete, and therefore unavailable to contribute in establishing those prophylactical measures that are to be adopted at present in accordance with facts well proved by observations duly interpreted. Notwithstanding this, the importance of these observations is so great that it can be said that in the majority of cases it leads to practical results of positive usefulness.

Exanthematic or petechial typhus is an endemic disease in this capital and throughout a very extensive zone in the Republic. It belongs to that group of infectious, contagious diseases about which bacteriological studies are not very far advanced, and the prophylaxis of which can only be established by the deductions of the known etiological datum.

My studies in the bacteriology of this affection, are as yet very incomplete, but lead me to think that the generating microbe of it is a *facultative micro-coccus* that specially lodges in the blood, and that grows with ease in broth and in peptone gelatine; but, as so far I have been unable to prove its presence in all diseased subjects and have not reproduced the disease by inoculating its culture in different animals, rabbits, dogs, calves, on all of which I have practised experiments, I cannot claim for my studies any importance, proposing to follow them up, so as, perhaps, to have the satisfaction of presenting them at some other opportunity before this distinguished society.

Typhus etiology has been the subject of many discussions, and though it may be stated that in the majority of subjects relating to it, medical authorities are in concord, there are some subjects yet, about which opinions, especially in Mexico, are not unanimous, and others on which certain differences about details may be observed. These are, however, of great importance, so as to fix with the greatest possible precision the manner in which prophylactic measures may be applied in accordance with the demands of the treatment of the disease.

The reasons above stated have decided me to present this work, in which I will treat about some questions in reference to the etiology and prophylaxis of typhus, without pretending that the ideas I set forth are entirely original. Though this essay may, perhaps, be devoid of any scientific or practical importance, I trust, however, that you will receive it with benevolence and only as a proof of my wishes to subserve in my limited scientific sphere, the high aims of the American Public Health Association, to which I now have the unmerited honor to belong.

It is known that there are two main causes of typhus infection and contagion. This proves to us that the germs of the disease are susceptible of development, as well in organism as out of it, and therefore that it is important to fix which are the natural means that act as the vehicles for its culture, affording the necessary conditions, or those more favorable for contagion to take place.

In my opinion one of the most favorable mediums in those localities with climatic or telluric conditions favorable to the development of the typhus germs, is to be found in fecal matters in decomposition to such a degree that their stagnation in the town sewers, house conduits, and water-closets must be considered as an eminent danger.

This thesis has been supported by Morris, who in 1872 observed in New York that in 360 houses where there had been cases of typhus, fecal matter was accumulated in the water-closets and conduits on account of their bad condition. Horner made the same observation at Philadelphia, and other eminent physicians have likewise done so in Mexico, and I consider it a conclusive proof also, and therefore I shall only mention some of the cases that have fallen under my observation.

In March, 1882, in the Hospice for the Poor, an epidemic broke out, that attacked the boys, but respected the girls' and old people's departments. The disease began among the inmates who were in a damp and badly ventilated sleeping ward on the ground floor, and the windows of which were fronting the water-closets. The epidemic broke out on account of the state of the water-closets, their contents being removed without the precautions of disinfecting them beforehand; furthermore, the fecal matters and mud were left in the court-yard fronting the sleeping ward. The physician of the establishment, Dr. Joseph Buizo, who was one of the victims of that epidemic, ordered that the children, as far as it was possible, should be sent back to their homes, that the fecal matters should be taken away from the court-yard, and that

the flag-stones over the conduits should be replaced. Notwithstanding these measures the epidemic continued its course, and in a visit to the establishment with Professor Doctor José D. Morales, on the 15th of said month, we found that the water-closets were of the worst system, as they had neither obturators nor water to wash them out with; they were in such a filthy condition that their stench could be noticed at a considerable distance off, and the fecal matters were stagnated from the starting point of the issue conduit, that on that account was perfectly useless.

After all the fecal matters had been disinfected and taken away, the water-closets improved, and the walls of the sleeping wards whitewashed, the epidemic began to abate and completely disappeared after a few days; and up to date has not broken out again.

This, in my opinion, is an eloquent fact, because if it is true that in the sleeping wards there was some agglomeration, this was not very striking, and furthermore, it was of long standing and its effects had previous to that time not been felt; the epidemic cannot be attributed to the water, the food, or any other general causes in the establishment, for how was it that it was only developed in the boys' department, respecting the other ones; if to these considerations we add that the first cases, which were very numerous, broke out just after the fecal matters were removed, and that the epidemic ceased as soon as the water-closets and conduits were cleaned out, I believe that there is reason enough to attribute the breaking out of the epidemic to the above stated causes.

The epidemic that broke out in September, 1882, in the Correctional School is due undoubtedly to the same causes. It began among the inmates who occupied a sleeping ward in the northern part of the first court-yard of the building, with windows overlooking the second court-yard, where at that time stood the water-closets. These were in the worst possible condition, to such an extent that the fecal matters overflowed and ran out into the court-yard. As I before stated, the epidemic broke out in that ward, and for more than 20 days all the cases of typhus were among the pupils that slept there; and some time elapsed before there were cases in the other wards. The number of cases in the whole establishment was about one hundred. It is to be remarked that at the entrance of the sleeping ward, where the epidemic broke out, there was a water-closet without a cesspool but connected with the general conduit, and though it was kept in a state of cleanliness, its stench infested the atmosphere of the ward, which, on the other hand, was poorly ventilated. Owing to the wise precautions that were enforced, isolating the patients, disinfecting and affording a good ventilation to the departments, stopping up the water-closet in the sleeping ward and conveniently arranging the water-closets and conduits of the establishment, the epidemic was checked, and has so far never reappeared.

Analogous cases have been observed in the prison, though somewhat more complex, but doubtless in this also the accumulation and decomposition of fecal matters exerted a great influence, and this led the authori-

ties "in this year" to provide for the expenditure of a large amount, so as to arrange conveniently the water-closets and conduits of this penitentiary establishment.

Numberless are the cases of dwellings where typhus has broken out, and therefore the inspection commission has been called on to visit them, where the conduits are found without any flow, choked up with fecal matters and filth in decomposition; I have collected many curious facts regarding this, that for brevity's sake I omit stating here, of infested dwellings where the epidemic has been checked, as soon as their privies and conduits have been properly cleaned out and disinfected.

The thesis that I here uphold is largely supported by the history of typhus in Mexico. Such are the facts, and though I cannot quote here from statistical reports, as I have them not on hand, there is no doubt, as it is proved by the experience of the oldest doctors and the general observation of the inhabitants, that this disease, even bearing in mind the increase of population, was formerly considered as endemic, though less common than at present and even it generally happened, as Doctor Austacio Martinez states, that it only broke out in winter and spring, and died off in summer and autumn. In my opinion that is owing to the fact that in former times the sewer system was very limited—the only ones of any service were those so built as to receive the rain-fall and other running waste waters. The general manner of getting rid of fecal matters was by means of movable vessels that were every day emptied into the night cars that carried those matters out of the limits of the town. The sewers have gradually been lengthened and now are extended throughout the greater part of the city, and are the recipients of rain-water, excrementary matter, and all kinds of refuse. If our sewers were well arranged, as the present government intends they shall be, by constructing a new system in strict accordance with sanitary scientific principles, my remarks would have no object in this case; but I believe that great stress should be laid on them when we take into consideration the defects of our sewers, their declivity, shape, inner covering, ventilation, and the volume of water that feeds them; these defects are so great that the sewers should not be really considered as channels or outflows, but rather like immense pools where solid contents remain stagnant, engendering unhealthy emanations and infiltrations that are daily making the ground of the city filthier, more unhealthy and mortiferous—characteristics that, owing to the nature and origin of the place, it formerly possessed.

To this must be added that if we study the improvements carried out in the capital, we can find no other causes to which the insalubrity can be attributed, but on the contrary many improvements of great importance have been carried out that have improved local hygiene but that have not been enough to counteract the pernicious effects that I have mentioned. Likewise in water-supply important improvements have been carried out, increasing the volume of water and protecting the liquid from contamination; the cemeteries in church-yards and other central localities have been closed up; many filthy ditches and gutters

have been filled in; most all the marshes that surrounded the city have been dried up, and trees have been planted on them; in the city itself the number of trees has been greatly increased; many streets have been paved over with impermeable paving, and the general cleanliness of the city has improved greatly. There remains yet to be carried out, as one of the most important factors, the sanitation of dwellings, which, since the publishing of the Sanitary Code, has been gradually enforced in the city. All these elements will doubtless be powerful auxiliaries to check the development of typhus, as well as of other diseases.

Rain has a great influence in the march of endemic typhus—at least in those countries that, like Mexico, have a defective sewer system, as can be observed in the statistical statement, hereto attached, of the mortality by typhus in the capital in 23 years, from 1869 to 1891. It can be seen by it that the death rate decreases in the months of July, August, September, October, and November, and increases in the other months. This influence is easily explained; for, with the rains, and more so when they are copious, two phenomena of great importance take place, viz., first, that the abundance of water in the conduits of the dwellings and sewers carries off at least a part of their contents and covers over the remaining portion with a sheet of water that retards the decomposition and prevents morbose germs from being carried off in the wind, and second, that the ambient waters increase, covering a greater height of land and preventing the fermentation that takes place in the subsoil. After the rainy season is over, the subterraneous sheet of water descends, and the layers that had been infiltrated are placed in favorable conditions for the organic fermentation in which the germs of typhus thrive.

For this disease, Patenkofer's theory may be said to be applicable, without the exclusiveness with which this author publishes it as to cholera and typhoid fever.

To misery and accumulation, at all times, a very important place has been given as causes of typhus. I also consider them important predisposive agents, or as breeding foci of organic putrefaction, which then become factors of the disease. In our times the movement of large armies by land and sea, in great masses but carried out in accordance with the precepts of cleanliness and sound hygiene, without typhus breaking out in them, as always was the case in former times, proves conclusively that the so called human miasma that man may breed is not the true factor, but that it pre-exists, and that what man does above all in large agglomerations is to afford it with an easy and rapid vehicle for its multiplication. When one case of typhus has appeared, there is no doubt that misery and accumulation will greatly aid contagion and that then it spreads wonderfully.

As to the last mentioned observation, we must state that it not only takes place in the period of development of the disease, but also in convalescence, and by observations made by Doctor Austacio Martinez, whose large experience on the subject entitles him to be mentioned

as an authority, it can be said that the patient is in a dangerous state even after 20 days have elapsed since the date of entering into convalescence. This is a very important fact for the application of prophylactic measures.

Typhus contagion, which seems to adhere to and maintain itself on clothing and other objects, as well as dwellings, is, so to speak, dense, heavy, but losing rapidly its virulent properties in the air, so that for one or the other reason it is slightly diffusible in the atmosphere. As proofs of this assertion, I state the following facts:

1. It is the commonest occurrence to see a case of typhus in one apartment without the disease spreading to persons living in contiguous dwellings in the same building, and when it does spread, the fact can be explained by the intimate contact of the neighbors among themselves or by the general conditions of insalubrity of the building that exerts its influence on all the tenants.

2. At the Juarez hospital, where there is always under attendance a great number of typhus patients, the disease does not spread among the wounded patients who are in the other wards of the same establishment.

3. Statistics prove that typhus is not more common amid the dwellers of the houses in the vicinity of said hospital, than among those who dwell in other quarters of the city.

4. It has been observed that, in the epidemics that have broken out in some establishments, the disease has only invaded one group of inmates, the others remaining untouched, though all of them are close neighbors, but without coming in contact, as happened at the Hospice for the Poor, to which I have referred, and also in the epidemic that broke out in the course of the current year in the national prison.

There are furthermore two important observations to be made, that induce me to believe that for the propagation of typhus by contagion it is necessary, at least in the majority of cases, that typhus germs invade the patient in large quantities, these observations being as follows: First, that it is relatively seldom to find typhus propagating among persons who enjoy some comfort and dwell in ample and well ventilated houses, while, on the other hand, contagion is very common among poor people who are obliged to live in the same apartment where the patient is, and second, that but very few of the physicians, practitioners, and nurses that have been in attendance on typhus patients at the Juarez hospital have caught the fever, and it is not common among doctors in their private practice.

Furthermore, it is unquestionable that to contract the disease there must be a certain individual predisposition, about which my studies and observations do not shed on me any light that might lead me to presume the reason, being only able to state, as interesting facts, that an individual once attacked by this disease enjoys thereafter nearly an absolute immunity, and that in localities where this affection reigns newcomers are more liable to catch it than those who are settled there.

Prophylactic measures are of two different kinds: the ones leading to the

improvement of the hygienic conditions of the locality and the others to prevent the spreading of the contagion. The first necessarily vary according to the special circumstances of each locality, but all must have as their main object the prevention of generation of putrifying foci of fecal and other waste matters of man or beast, and procuring the healthiness of the soil; the second ones regard the isolation of patients and disinfection.

To prevent the agglomeration of the so many times mentioned focus, it is necessary in large cities to adopt a good sewer system and compel proprietors by legal means to have the water-closets and outlet conduits in their buildings properly ventilated and with the necessary means for the drainage of waste waters, to prevent wall and floor infiltrations, and the leakage of gases into dwellings; in towns and villages of small means the system of movable vessels should be preferably adopted, and on farms and large country estates care should be taken that dunghills are in a suitable position as to the dwellings, that the floors and walls, at least to a sufficient height, be provided with an impermeable coating, and that there are necessary depositories, likewise impermeable, for the collecting of the liquid from the said dunghills; the water-closets may be either fixed or movable pits, but in the first case care should be taken that they are at a good distance from the dwellings, are well ventilated, and with well-built walls, cleaned out often and the contents carried to the fields to be used as fertilizer.

The sanitation of the soil by means of porous tubing that lowers and fixes the level of subterraneous water will not be indispensable in every city; but in those of essentially clayey soil and where ambient water is at a slight depth from the surface, as in Mexico, this precaution is quite necessary.

Isolation of patients should be carried out on the following basis:

1. Preferably they should be taken to the hospitals.

2. However, they may be allowed to remain in their dwellings, when the family is not a numerous one, the patient occupying an ample and well-ventilated apartment, and only those in attendance going into the room.

3. Patients in hospitals and private dwellings will be preferably cared for by those who have had typhus.

4. Isolation shall continue for 20 days after convalescence.

5. Hospitals for typhus patients need not be at long distance from dwellings.

6. A department must always be provided for convalescents or they shall be taken out into the country.

7. The measures of personal cleanliness, food, change of clothing, disinfecting, etc., to be carried out by attendants of typhus patients should be the same as adopted for other contagious diseases.

8. Disinfection should be carried out on the patient, his dejections, bed and wearing clothing, and apartments where he has been cared for.

9. It is very important that through popular teachings profusely dis-

tributed the public should be made acquainted with the rules to be observed for the isolation of patients, with the appropriate manner of using disinfectants, and all other measures to avoid being attacked by such a terrible disease.

Such, gentlemen, are briefly sketched the ideas I entertain about the etiology and prophylactic of exanthematic typhus, which I have the honor to submit to the deliberation of the enlightened persons who have deigned to lend me their attention.

STATEMENT

Of the deaths by typhus that have taken place in the city of Mexico in twenty-one years, from 1869 to 1889.

Year.	Winter.				Spring.				Summer.				Autumn.				Totals.	General mortality for each year.	Proportional per cent. as to gen'l mortality rate.	Observations.
	Jan.	Feb.	Mar.	Total.	April.	May.	June.	Total.	July.	Aug.	Sept.	Total.	Oct.	Nov.	Dec.	Total.				
1869	16	28	16	60	16	24	30	70	16	19	19	54	19	18	18	53	237	7,447	3.33	
1870	31	16	23	70	21	22	15	58	13	25	16	54	21	19	18	40	222	7,733	2.87	
1871	16	22	37	75	34	15	30	79	14	17	10	41	18	16	8	42	237	7,640	3.10	
1872	10	15	16	41	28	15	13	56	12	15	15	42	6	9	9	24	163	8,172	1.90	
1873	8	17	6	31	19	20	19	58	16	21	11	48	7	15	16	38	175	6,961	2.51	
1874	30	26	19	75	16	21	21	58	28	15	8	51	12	30	43	85	269	8,453	3.18	
1875	39	42	52	133	70	73	58	201	60	75	60	195	82	90	125	297	826	9,217	8.95	Epidemic in the years 1873 to 1877.
1876	127	118	141	386	131	145	133	499	126	114	93	333	94	113	147	354	1,482	10,390	14.26	
1877	162	129	188	479	227	156	91	474	58	47	32	137	14	19	22	60	1,150	12,242	9.39	
1878	20	12	33	65	24	35	30	89	19	16	9	44	12	15	7	34	232	10,164	2.28	
1879	13	14	21	48	19	13	10	48	14	13	9	36	12	29	12	53	185	10,223	1.81	
1880	17	10	23	50	14	19	15	47	10	10	9	29	7	13	13	33	159	9,455	1.68	
1881	17	20	17	54	28	31	17	76	19	15	11	45	17	12	17	46	221	9,687	2.28	
1882	20	24	21	65	32	40	20	92	10	12	11	33	10	10	25	45	235	11,523	2.90	
1883	43	36	37	116	69	41	37	147	26	50	36	112	44	56	47	147	522	12,047	4.33	
1884	102	100	98	300	96	104	68	268	63	47	26	136	35	40	41	116	820	12,803	6.40	
1885	52	43	72	167	59	65	62	186	48	55	32	135	24	38	34	96	584	13,067	4.47	
1886	43	46	54	143	57	53	58	168	42	34	39	115	39	39	55	133	559	13,102	4.26	
1887	57	46	62	165	36	61	37	134	25	35	26	86	38	38	55	131	516	13,200	3.90	
1888	79	53	87	219	50	67	55	172	43	31	37	111	48	38	59	145	647	13,221	4.89	
1889	101	100	129	330	125	95	82	302	54	57	43	154	42	63	74	179	965	15,436	6.25	
1890	87	66	110	263	109	13	72	274	55	58	47	170	64	73	87	224	921	16,520	5.55	
1891	111	129	157	397	143	157	89	389	69	48	37	154	40	33	32	105	1,045	15,236	6.85	
	1,201	1,112	1,419		1,423	1,364	1,068		840	829	636		710	824	946		12,372	254,009	4.87	
	3,732				3,855				2,305				2,480							

XII.

NOTES ON THE COMMUNICATION OF DISEASE IN PUBLIC PLACES.

By WILLIAM THOMAS CORLETT, M. D., L. R. C. P., London.

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My apology for presenting a subject so familiar to physicians, and for calling attention to dangers so well recognized by them, is that neither the subject nor the dangers to be enumerated are familiar or even recognized by the public at large.

Of all diseases, those arising from parasites or micro-organisms are most frequently communicated in public places. Representative of the animal parasites is the pediculus, which possesses, among other things, the instinct of migration, in common with some of the higher orders of life. It is in the caput covering of children that it finds the widest range for gratifying this desire to find "plains whose verdure no foot hath pressed." The changing of hats and caps so common among school children, the hanging of coats and cloaks on the same hook, enables the parasite to travel from one garment to another and in this way phthiriasis capitis is communicated. Another variety of pediculus attacks the body, and finds its habitat in the clothing. Its communication is due therefore, in many instances, to unclean bedding in public sleeping apartments, jails, etc. The disease is most frequently met with in old people. A third variety attacks the pubes. From its position, the usual mode of contracting the disease is by sexual intercourse; it may also be taken from unclean or infected bed-clothing, or from the seats of water-closets.

The acarus scabiei, which is the presiding genius over scabies or "itch," may be communicated by shaking hands, from clothing, and from towels. It is a common disease among school children, although no age is exempted. In a number of cases which have come under my observation, scabies has been contracted from hotel beds and from sleeping cars, the latter especially offering accommodations unsurpassed for their transportation.

The vegetable parasites are also communicable, and of these the tricophyton is the most common as well as the most important. This parasite gives rise to three diseases, spoken of collectively as trichophytosis. The first, encountered on the scalp of children, is called tinea tonsurans or "ring-worm." It is highly contagious and spreads by means of

pillows, hair brushes, or from changing hats, which is so frequently done among school children. It frequently goes through large institutions for children like an epidemic. On account of its persistency it may remain a source of danger for years. Tinea circinata is the second variety, also called "ring-worm," on account of the circular form of the eruption, which before the microscope revealed its true nature was thought to be due to a worm. This eruption occurs on the body, and is communicated as is the preceding disease. Again, the tricophyton attacks the bearded face of men, giving rise to tinea sycosis, the third form of trichopytosis, commonly called "barber's itch." Nor is popular opinion, which ascribes to it a tonsorial origin, misleading, for of the cases of tinea sycosis that have presented themselves for treatment but few can be recalled that have not been contracted in a barber-shop. In most instances the patient stated definitely that on a certain time his face was scratched or cut, thereupon an inflammation ensued which was persistent, and finally on examination the trichophyton was found.

The achorion, also a vegetable parasite, may be communicated in the manner pertaining to others of this class. As this disease, tinea favosa, is mainly confined to Scotland, Poland, and some other countries of Europe, its consideration here is not important.

The microsporon furfur gives origin to but one disease, tinea versicolor. Less contagious than others of its class, it is sometimes communicated from husband to wife, and vice versa, seldom in public institutions.

Alopecia areata and alopecia praematura are diseases that have elicited the most careful inquiry, supposed by some to be of parasitic origin and therefore communicable. Gruby in 1843 first detected a fungus growth which he called microsporon audouini. Thin, more recently described minute bodies, having the size, shape, and refractive qualities of bacteria. Wickham of Paris, in a paper that I had the pleasure of reading for the author before the American Medical Association in 1890, cited a number of cases of alopecia areata strongly pointing to contagion and in which a peculiar micro-organism was found. According to these observations the prevention lies in discouraging the exchange of hats and the promiscuous use of combs and brushes.

There is another class of diseases due to a specific poison or germ, whose chemical and physical properties have not as yet been definitely determined. Under this class come the exanthemata. Boards of health have adopted stringent measures to prevent the invasion of this subtile poison into schools and other institutions where children are congregated; but in sleeping cars, with heavy draperies, insufficiently ventilated, giving out the musty odor so characteristic of them, the danger is imminent. Scarlatina, morbilli, and variola are frequently communicated in this way.

Of a different nature, yet under favorable conditions none the less liable to contagion, is gonorrhea. Here the danger arises from the gonorrheal virus adhering to urinals and to the seats of water-closets.

Of all diseases liable to be communicated in public places there is none of greater importance than syphilis. It is not necessarily a venereal disease. The various modes of inoculation and the facility with which the virus is transmitted, renders every affective person a focus of contagium. Bulkley has compiled an exhaustive report which shows the frequency of syphilis due to inoculation other than by sexual contact. These statistics futher show the grave importance of the subject to boards of public health; and that ignorance or carelessness on the part of those to whom the public applies for aid, should be considered a crime. Syphilis is frequently communicated in glass-blowing establishments. While in England I remember having seen four cases, with indurated chancres in the mouth, contracted in this way. Drinking vessels are likewise a frequent source of contagion, and it is a question whether public drinking fountains are an unmixed good. I believe they are a source of danger. Public towels, whether in the wash-rooms of hotels, in cars, or in factories, may be the means of transmitting syphilitic virus. Combs and brushes used by the public should be regarded with equal suspicion. As to public baths, those resorted to by syphilitics should be studiously avoided. Turkish baths are especially liable to become contaminated, because many physicians advise them in the treatment of syphilis. Proper precautions, therefore, should be taken on the part of the attendant as well as the bather. Syphilis among waiters is a very common disease. Their roving and irregular mode of life subjects them to exposure, while treatment among them is seldom continued sufficiently long to effect a cure.

Since the discovery of Koch, the tubercle bacillus has become a definite entity. Its subsequent cultivation has demonstrated that to this bacillus are due diseases hitherto regarded as distinct and dependent on various etiological factors. This discovery was foreshadowed by histologists when they pointed out the similarity in histological structure between lupus and tuberculosis of the lungs; but preventive medicine could do little, how little was not really known until these diseases were demonstrated to arise from a *materies morbi* outside the organism, the bacillus tuberculosis, and lupus and phthisis were relegated from the idiopathic to the specific contagious diseases. The tubercle bacillus attacks different structures according to the age of the individual. Thus in childhood the coverings of the brain and spinal cord are most frequently involved, giving rise to cerebro-spinal meningitis. Later, between the ages of eight and twenty, the skin offers the point of least resistance, and lupus is the result. Still later in life, and mainly during the next decade, the pulmonary tract succumbs to this potent destroyer in the form of phthisis. The environment necessary to keep the bacillus alive is seldom absent in humid climates, and already sufficient clinical proof exists that the tubercle bacillus may be inoculated from one person to another, and, according to the structure, one of the forms of tuberculosis above mentioned will ensue. The greatest danger exists in sleeping cars and in hotels. The expectoration of

tuberculous matter is profuse and constant, the sputum dries, is carried by the wind, is inhaled or swallowed, or finds a nidus on the abraded skin. In the United States during the winter months thousands of unfortunate invalids, coughing, expectorating, flock to the health resorts of the south and west. Railroads vie with each other in soliciting their patronage; hotels scatter broadcast seductive reports setting forth their natural and special inducements to seekers of health and pleasure. Is it necessary to comment on the sequel? Is it not enough to say that from the moment they enter the elegantly upholstered Pullman to the time when they set out on that long journey from whose bourn no traveller returns, they are sowing the germs of disease; that in cars and in hotels delicate organizations are thus brought directly in contact with the afflicted, with the very germs they are least able to resist; that the strong are exposed, in the same way, to an infectious disease which carries off in the United States alone one hundred thousand annually, and is far more deadly to the race than leprosy or cholera? Estimating three years as the average life of the consumptive, there are to-day in the United States three hundred thousand active agents spreading the disease.

How prevent these evils that menace the human race? How fetter this monster ycleped disease? These are questions this Association should consider.

In brief then, the knowledge that they exist is of the first importance. Cleanliness comes next. Not the indifferent show of cleanliness the table waiter and the car porter so often exhibit, but that thorough cleanliness prompted by the understanding, which approaches the nearest to godliness. Boards of health should establish regulations against the spread of syphilis and tuberculosis, as strongly as against small-pox and cholera. Physicians, when any contagious disease occurs in waiters, bathing attendants, or others brought in intimate contact with the public, should be compelled to report the same to the proper authorities. Further, there should be a careful inspection of dwellings, public buildings, and conveyances which should provide for their disinfection after harboring, or carrying, contagious or infectious diseases. These measures, it seems to me, can only be carried out by the concentration of power—by the creation in every country of a national board of health, to which the boards already existing in many states of our own country should contribute to form one comprehensive whole. In the mean time, the people should be enlightened, and in so doing the most powerful means of prevention will be attained.

XIII.

THE MECHANICAL FILTRATION OF WATER, AS A METHOD OF PURIFICATION. BASED ON THE INVESTIGATIONS BEING MADE AT THE MUSEUM OF HYGIENE, WASHINGTON, D. C.

By HOWARD E. AMES, Surgeon U. S. N.

In the holy book of the Vedas we find these striking commands: "Do not spit out with retching in the water. Do not pass urine, or discharge excreta in the water. Do not drop blood into the water. Do not throw any hair, or nails, or bones, or ashes, nor dip dirty clothes into water. For, to do this is to abuse a precious gift of the gods and disgrace them." And Menu, the law-giver, says, "Let him not cast into the water either urine, or ordure, or saliva, or cloth, nor any other thing soiled with impurity, nor blood, nor any other kind of poison." Truly, these are remarkable commands, and could more easily be considered the instructions of a modern sanitarian than the utterances of centuries ago. The most important factor in the prolongation of life and preservation of health, in any community, is a wholesome water-supply. To secure this is the duty of all; and we, as sanitarians, should not only bend our best efforts but should impress upon the people, and particularly our legislators, the importance of maintaining it as pure as possible.

Twelve years ago, Dr. C. F. Folsom, of Massachusetts, addressed this Association on the "Pollution of Streams," the main object of his remarks being to secure a pure water-supply. The laws which he formulated have born fruit, but the crop has been small—less than they merited. Ahead of other states, in water investigation, Massachusetts has done, and is still doing, a blessed work. Our streams are polluted to a dangerous degree, and I fear this will continue as our population increases; the evil has been diminished in some localities, but has not been stopped. We still depend upon our streams for the principal water-supply, and the question is: how to improve those polluted waters? The terrible and wanton destruction of forests, denuding hills and mountains, has created a disastrous condition in the rivers; equally dangerous periods of flood and low water. When scarcity exists and the rivers are low, the contamination of the water is greater in proportion. The most disastrous epidemics of typhoid and cholera have gathered their richest harvests of human life during periods of low water. The two papers read by Dr. Baker before this Associa-

tion, the reports from Europe, Egypt, India, China, and Japan, all give the same experience. That water is the principal medium through which the death-dealing germs travel and reach us, is I think undoubted: even the most careless student of the past admitted that the evidence was strong that water was our most deadly enemy during these plagues. The recent works of bacteriologists, and the priceless and wonderful discovery by Robert Koch, in 1883, of the comma bacillus, gave a new energy to the civilized world; and we now have the knowledge and appliances to recognize, positively, the cause of one of man's most terrible scourges and bring it within the possibilities of holding it in check and obliterating it from the face of the earth. Koch accredits water with being the principal disseminator of cholera and of typhoid, and considers that—sewage contaminated water—is the most active agent in the propagation of both these germs. When we reflect on the rapidity with which a traveller is carried by the railroad, and the defective water-closet arrangements in our passenger cars (which, instead of containing closed, but well disinfected, excreta tanks to be removed at stated intervals, are open at the bottom, allowing the excrement to fall along the tracks into drain, or stream, with its paper contaminated with typhoid or cholera easily scattered by the wind; and these dangers strewed along 1,000 miles of railroad in twenty-four hours), we can readily discern the ease with which modern times pestilence is spread over our country. The admixture of a small quantity of cholera or typhoid bacilli in water is sufficient to spread the disease in a community. The pollution of the streams in England, particularly of the river Thames, has caused the expenditure of many million pounds, in improving her water-supply. The different governments on the continent have been working in the same direction. The good work performed by the filter-beds of England, has commanded the attention of all sanitarians. The purification of water in large quantities for domestic and industrial use can only be satisfactorily and economically done, either through large filter-beds by gravity, or by specially devised machines under pressure. And it is the object of this paper to give a brief summary of the results so far obtained by the latter system, at the Museum of Hygiene where experiments have been conducted for the past eighteen months, and are still in progress. A full report we hope to have printed. The high pressure, or mechanical, method, is the one making the greatest headway in the United States, and we think, by far, the cheapest and best. The filtering machines consist of strong iron cylinders, placed upright in the small, and horizontally in the large. The sizes vary in diameter and length according to the quantity of the water to be filtered. Some of the filter companies construct cylinders as large as fifteen feet in diameter and twenty-five feet long—a grave error, as I will prove later on. The pipes are connected with the cylinders in such a way that the water can be carried on to the top of the bed for filtering, or let in at the bottom to wash out the sand-bed after it becomes embarrassed, or clogged, by the accumulated foreign matter on the top. This deposit may be better called a blanket,

and is mostly confined to the surface or, at most, the upper two or three inches of the filter-bed. In washing out the bed by the reverse current, when completed, the water comes out as clear as the tap-water. The sand or filtering material is held in the cylinders by suitable contrivances, called sand-valves, placed at the outlets, and proper screens at the inlets. The washing-out is facilitated by agitators or stirrers, cutting plates, section partitions, or cone-shaped bottoms. I think the agitator, or stirrer, mounted in the axis of the cylinder is the best, as it does the washing more quickly and thoroughly than any of the others. The time required to wash out the bed depends upon the condition of the water; from one-half to an hour will cover all conditions. Some filters consist of two cylinders placed either side by side, or one above the other; by this arrangement, the washing can be done with filtered water, by filtering the water through one and passing it through the other. This is an advantage, as it insures a cleaner bed after the washing out is completed. The types into which these machines may be classed, in regard to filtering materials, are: sand or ground quartz, sand and animal charcoal, ground quartz alone, and pyrolusite, or polarite and ground quartz. I consider ground quartz the best material, as the edges of the particles are sharper and it packs more easily. Charcoal is useless; for, if not frequently aerated it is a nidus for micro-organisms; and if kept under water, its action is nil. Nothing can be said in favor of polarite so far, and the future seems to offer no hopes. All the machines have attachments for dosing the water with alum, when the conditions require such treatment, and when properly used it is of the greatest benefit. At first, we had difficulty in regulating this, from the crudeness of the feeding devices; but, happily, we now have an alum-feed, the blessing which completely overcomes this trouble. With crushed quartz for the filter-bed and a proper dosage of the alum, these machines meet all the requirements for a pure water-supply. In certain conditions, the sand alone will suffice; at other times, the water carries a heavy proportion of fine clay, which several thicknesses of the best Swedish filter paper will not remove; and the water, passing through the machines, is not clarified. In such cases, alum gives excellent results by massing the fine particles that are suspended in the water sufficiently to be held upon the surface by the sand. The cause of this coagulation, or precipitation, is due to the reaction between alum and calcium bicarbonate, forming calcium sulphate and aluminum hydrate and carbon dioxide.[1]

When the water is properly dosed, all of the alum will be caught in the filter bed; if, on the other hand, an excess is introduced into the water, the amount in excess will pass through the filter undecomposed, and the

[1] This reaction is expressed as follows: assuming potassium alum to be used and writing the carbonates all as calcium carbonate:

$$2KAl(SO_4)_2+3CaCO_3+3H_2O=K_2SO_4+3CaSO_4+3CO_2+2Al(OH)_3$$

Of course it will be understood from this reaction that water entirely free from any of the soluble carbonates has no action on the alum. If it is high in any of these the amount of alum could be increased proportionately without fear of its passing over into the filtered water.

water be correspondingly impregnated. The largest amount we ever recovered from these filters, with alum valve wide open and the filters flowing at their greatest capacity, was 5.958 grains per gallon, the average amount 0.779 grains per gallon, while the average amount found in the wash water was 452.81 grains per gallon, which indicates that the alum is largely retained in the filter-beds. The alum enables the beds to more thoroughly purify the water, but the bed is quickly clogged, requiring more frequent washing. The amount of work these filters may be called upon to perform is better understood, when we consider that some of the western rivers of the United States at times carry as much as an ounce of fine mud to the gallon; so a filter capable of filtering 250 gallons per minute would be charged with 15½ pounds of solid matter in the same time; even ¼ ounce to the gallon is a severe test. In such cases, a sedimentation bed would be almost a necessity. By experiments at the Museum of Hygiene, it was found that the flow was diminished by the blanket, rather than by particles that penetrated the bed. This was carefully studied with the aid of a glass model. A sudden jar would sometimes disturb the blanket sufficiently to renew or restore, momentarily, the flow to its full capacity. The question arises, What effect has rapid filtration on the purification of water from a chemical standpoint? Omitting tabulated records, I will briefly give the averages of the four filters with which we have been working: The albuminoid ammonia is reduced 69¼ per cent., which shows that rapid filtration has a marked effect in removing organic matter. Free ammonia is occasionally slightly increased: this is readily understood by the breaking up of the albuminoid ammonia. When ammonia alum is used, as a coagulant, this is markedly the case, and should be borne in mind when estimating the chemical efficiency of a filter. Nitrites and nitrates are occasionally reduced, but for all practical purposes are not worthy of consideration beyond the fact that they are reduced in some cases, and occasionally increased; but in rapid filtration the time is too limited for oxidation to take place in the organic matter, which is necessary for an increase in these substances. Chlorine is not appreciably affected, but the amount in the water on which we have been working is so small that more extended investigations are required to determine the point. The temporary hardness is reduced one per cent., but the Potomac water is soft (67 parts per million); with harder water the results might be more marked. The suspended matter is reduced 50 per cent. by simple sand filtration. Mineral matter in solution is slightly reduced. Before speaking of the bacteriological results, I will briefly call attention to those that have been noted by others on the effect of simple filtration, on the removal of micro-organisms. Their removal is mechanical—as Koch has shown that a 4 per cent. solution of alum had no effect upon cholera, or typhoid, bacilli, and a concentrated solution of calcium chloride was harmless to them. So their removal must be due to their entanglement in the sand, or coagulant, when used. Dr. Percy Frankland asserts that the London water com-

panies do eliminate 96 per cent. of the micro-organisms from the Thames through three feet of sand.

The water of Alexandria, Egypt, after imperfect filtration through very coarse sand gave in 1c. c. 1,320 germs or micro-organisms; before filtration 46,000. After a second filtration through the porous drip jars commonly used in the better Egyptian houses, the reduction was made to 120. The report of the biologist of the state board of health of Massachusetts states that some species do pass with difficulty through common sand, but thinks their filtering through fine sand doubtful. At the Museum, the filters removed 98 per cent. of the micro-organisms, as found by direct experiments in plate culture. We do not believe that any filter is perfectly germ-proof; spores often pass through the filtering material. Many times we have made, on carefully prepared plates, both with and without alum, cultures of distilled, filtered, and tap water from the Potomac, with absolutely sterile results from the distilled and filtered water while the tap water plates swarmed with colonies—remarkable results. The results here given were not obtained by coddling the machines; in fact, they have been given the most severe tests. We have pushed them to their full, when really they should be used only at the rated capacity. When we complete the investigation, I think that the intermittent flow, at the rated capacity of the machine, will give better results. Several points in these filtering machines should be considered: one is the size of the cylinder, and the flow of the water in washing the bed; as all of them depend upon the upward flow of water for cleansing. The rate of flow through the filter depends upon the proportions between the inlet pipe and the area of the filter-bed; allowance being made for the sand in the cylinder. You will readily see that the area should not be too large, or the flow too slow. In hydraulic engineering it is good practice to arrange for area that will give a velocity of 150 feet per minute through pipes, and this is considered the standard. Most of the filter manufacturers gauge the size of the pipes to and from the filter on this scale; and in all the filters of a capacity of 250 gallons per minute, the inlet and outlet pipes are 5 inches, the area being 28.27 square inches, the 10 feet cylinder having 78.50 square feet of filtering surface. Here we have a cylinder velocity about 400 times slower than the rate of the inlet pipe, so that the upward current (allowing for the sand) is only 5.1 inches per minute for the 250 gallons of water and sand. If we double the amount of water used in cleaning, we only get velocity of 10.2 feet per minute; and this is not enough to clean out a large filter-bed thoroughly; in fact for such a large bed three times the amount would be required to secure sufficient velocity. And thus we see 750 gallons per minute— a waste of three times its capacity; if filtered water be used to wash with, the water from three filters will be required. Some of the manufacturers have noted this defect and are making their filter-beds smaller and more numerous. One company now uses two cylinders of 5 feet each, instead of one of 8 feet, for the same capacity of water—a wise and scientific move, for it secures better and quicker cleaning with

less water, stronger construction with the same thickness of plate, and less crippling of the plant in case repairs to any filter are required. A stirrer, or agitator, is advantageous in breaking up the bed to secure rapid and efficient cleaning; the upward current is liable to cut a course or channel, the rest of the bed being dead or clogged. This fault occurs in large filter-beds. A study of these points was made with the aid of two glass models, and clearly showed the advantages of some means of thoroughly breaking up the beds. Time is saved, and water also; both important factors, particularly in the latter case where the supply is an impounded one. Regarding the use of alum and its effects upon the health of a community, this is an open question: if properly used, no deleterious effects can follow, and we can only argue on our knowledge. Practice shows that 1-2 grain to the gallon is sufficient for most waters, and if properly applied only a trace will pass into the water. The amount of alum used at Atlanta, Ga., where they have a filter plant of 3,000,000 gal. daily capacity, was 0.067 grs. per gallon, say 1-15 gr. In Washington (D. C.), during a large part of the year, alum is not required. The mechanical filtration is adopted at the following places and reported as satisfactory:

Oakland, Cal.,	capacity for 24 hours	4,000,000
Atlanta, Ga.,	" " " "	3,000,000
Long Branch, N. J.,	" " " "	2,000,000
Athol, Mass.,	" " " "	1,000,000

An unlimited quantity can be filtered by these machines. A plant to filter 50,000,000 gallons daily would cost about $350,000; the space required would be about 25,300 square feet, or a building 300x125 feet, this will give abundant room. A rough comparison between the areas required by the filter-bed system and that required by machines to do the same work shows, that the London filter-beds cover an area equal to 102½ acres; while 1½ acres would suffice for filter machines. The rates of filtration by the two methods explain this:

On the London filter-beds the rate is 1½ gallons to 2 gallons per square foot per hour; the machine rate is 3 gallons per square foot per minute. Our conclusions are, that mechanical filtration is the best system yet devised. It has its advantages over the filter-bed system in uniformity of action, rapidity in cleaning, protection from light and floating particles in the air; and the inability of lower organisms to secure a footing, greater surety of a steady supply, freedom from freezing, the non-removal of the bed, and its non-disturbance by local rains, the ability to wash the beds with filtered water, and less cost to establish and maintain. We have been working with the Blessing filter, of Albany, N. Y.; the Loomis of Baltimore, Maryland; the Hyatt, of Newark, New Jersey, and the Bowden, of Detroit, Michigan. The illustrations will give a fair idea of the construction of each.

These are first-class machines for the filtration of water for household purposes. It is true that all germs are not removed by the filters,

but the enormous percentage dislodged is just as liable as not to embrace those of disease-producing character; this much is a substantial gain as averting so many possible cases of infection.

Other experiments have been made on household filters, but as they belong to a separate class and are not suited or intended to filter water on a large scale I have not included them. I will say, however, that the results obtained do not differ materially from what I have given.

The Pasteur-Chamberland, and the McDonald filters are both porous porcelain tubes through which the water is forced by pressure. The sediment formed on the tube may be considered the blanket, and checks the flow. The latter has an automatic cleaning attachment, which is simply a mass of sand that is kept in motion during washing around the outside of the filter tube, which removes the blanket by attrition: this is assisted by the back pressure, which depends on the air cushion formed in the tank, which lifts the blanket and enables the sand to sweep it off. These are the essential differences between the two. They are not constantly germ proof, in fact, we have found no filter absolutely so. They do not use alum.

XIV.

OBSERVATIONS ON THE HYGIENIC CONDITIONS OF THE TERRITORY OF TEPIC AND THE PACIFIC COAST OF MEXICO.

By Dr. JUAN REVUELTAS.

Tepic, Tepic Terr., Mexico.

The territory of Tepic, in which I occupy the position of sanitary medical inspector, is situated between 20° 42′ and 23° 25′ north latitude and between 40° 45′ and 6° 48′ longitude west of the meridian of Mexico, with a superficial area of 47,480 square kilometers. It is bounded on the west by the Pacific ocean, on the east and south by the state of Jalisco, and on the north by the states of Sinaloa and Durango. The climate is temperate in the higher parts of the territory and warm on the coast, but at the same time not excessively hot, as the maximum temperature very seldom exceeds 98° F. in the lowest part; in the winter and in the highest part of the territory, its minimum temperature is 35° F. The average rainfall in this territory is 1.25 m. to 2.30 m.

The city of Tepic, capital of the territory, is situated at an altitude of 934 m. above the sea level.

Its soil is exceedingly fertile, irrigated by several rivers, which discharge into the Pacific ocean. Only a small part of the territory is as yet cultivated, and the system under which this work is done is very defective, but, nevertheless, in some parts of the territory even three crops are harvested in the year, and as yet we have no record of any bad year in the memory of the oldest inhabitant.

The territory produces abundant crops of coffee, cotton, tobacco, and a great variety of other products, so much so that in some years a large part of the crop is lost for want of a market. The hygienic conditions of the entire territory are generally good, though a few swampy places exist near some of the towns, and they are due to the carelessness of the inhabitants or to the avarice of the landed proprietors. These are about the only sources of malaria in the territory.

Everything that is said with respect to the climate, productions, and hygiene of this territory can also be said with respect to the whole of the Pacific coast which is included in the National Territory, from the mouth of the Rio Colorado in the Gulf of Cortes down to Soconuzco in the state of Chiapas, with very slight modifications.

The prevailing diseases are, in the first place, plaudism in all its protaic forms, which fortunately are of a mild character and always yield to the administration of quinine.

If there is anything perfectly well known in the science of medicine, it is the origin of the parasitic microbe which causes palustric fevers in humanity.

Dr. Laveran has made some most remarkable studies in Africa upon this same point, which have very justly been highly praised by the Academy of Medicine in Paris, and the practical results of which have proved the exactitude of his inferences. It would be an immense advantage if we could find in medicine such an efficacious antidote for all diseases, as we have in the use of quinine, both as a prophylactic and as a cure for all kinds of palustric diseases, and upon this special point, before a congress of practical and scientific men, it is only necessary to relate certain special facts referring to this coast, which as yet have not been written.

The inhabitants of these districts, after a careful investigation, have proved that one of the most certain ways of contracting palustric fever is the drinking of milk from the cows that are pastured in the neighborhood of the swamps, and although all cattle appear to present a certain immunity from malaria, nevertheless, I know of an intelligent and practical cow keeper, who has cured and is still curing diseases in his stock, which have not been diagnosed in a scientific manner for want of a veterinary surgeon, by means of injections of sulphate of quinine dissolved in an acid and applied in doses of four to eight grammes per day.

Another source of propagation of the malaria, comes from the water proceeding from low spots, for which reason the better educated people commonly boil their water before drinking, but those who can, always consume the water proceeding from springs in elevated places, which are very abundant, considering the number of inhabitants.

It is a common thing to see children who are still in the stage of lactancy, and who have no other nourishment than that derived from the breast of a nurse, attacked by intermittent fevers, when the women who are nursing them do not present the least sign of palustric hematozoaria, and these children are cured by the administration of salts of quinine applied to them through the nurse. This is a very plausible proof that infancy offers less resistance, or that persons can be acclimatized to malarial fevers as well as to yellow fever.

European authors say that there can be no acclimatization to palustric fever, seeing that the persons who are attacked by it, instead of being afterwards impervious to the disease, are, on the contrary, more susceptible to new attacks than before the first. This is true, but it is also true that in equality of circumstances between the individuals who are not acclimatized, there are more cases among those who are so acclimatized, always provided that the first do not observe the rules of hygiene.

Another thing to be remarked is, that a disease has developed itself among the stock which has been imported for the purpose of crossing with our native cattle, which, among other symptoms, presents that of an elevation of temperature to 40 or 41° C., and which disappears on the

administration of hypodermic injections of quinine, without ever re-appearing on the same animal, but which kills the animals when they are not treated with this valuable specific.

The young of these animals which are born in these places of pure-blooded parents, contract the same disease, and die if not treated with injections of quinine.

All these facts undoubtedly speak in favor of an acclimatization to the malarial atmosphere, and show that this is more durable in the lower animals than in man, perhaps because the former have a more regular life and system of feeding than the latter.

The good results obtained by the use of quinine as a preventive against swamp fevers, is a fact that has been proved by numerous examples well known to all physicians practising in those districts, and they fully prove the observations of Laveran in his work on palustric fevers. A daily dose of 0.25 to 0.50 centigrammes is sufficient for this purpose.

The country people consider that they obtain a good prophylactic by burning large quantities of bones and horns from the animals that have died on the farms, the ashes of which form a magnificent manure for the soil. They say that the smoke produced by the combustion of these substances diminishes and even eradicates the fevers for a certain time; but there is not the slightest doubt that the real way to sterilize the palustric germs is to be found in the observation of the wise rules of life published in our sanitary code, and by the planting and cultivation of trees in the low-lying lands, a resource that is easy and at the same time certain in its results.

Among the prevailing diseases of this territory, the gastro-intestinal affections take the second place, but although these cause a good deal of sickness, they can hardly be considered under the heading of hygienic studies, because they generally originate in the abuse by ignorant people of the great variety of fruits produced by the soil, and in the anti-hygienic style of their food, as among the people of any education these diseases are very rarely found.

With respect to the epidemic of yellow fever which was propagated on this coast in the year 1883, by importations in our ports through the steamers arriving from Panama, we can only say that no such case has happened since the beginning of the present century, when it was also imported in a similar manner. In 1883 it was observed at an altitude of 500 feet over the sea level, that the epidemic did not attack anybody, although many of the people who had contracted it in infested places came there to die.

The descent from the highlands to the coast is very abrupt, so much so that the smallest of the rivers, which is that flowing through Tepic, contains falls of water which are capable of giving movement to all the machinery of Manchester, according to the respectable opinion expressed by Mr. Somellera, manager of two of the large factories which are operated by only one of these falls, which also moves two other factories

belonging to the house of Barron Forbes & Co.; and in this rapid descent is where the dividing line of the epidemic was prominently shown.

The persons who were most susceptible to the disease and fell in greatest numbers under its attacks, were the people who suffered from anaemia, people of weak constitution, whose digestive organs were impaired, and especially the hard drinkers. So bad was this that the disease carried off not only the regular drunkards, but also those who made a less exaggerated use of alcohol. Generally we can say, that very few persons escaped the epidemic in the places which it invaded, and the only people who escaped were those who led a temperate life, as if the germ of this formidable disease found its development fostered by alcohol.

With respect to the propagation of yellow fever, it was perfectly proved on this occasion that it was carried forward by means of the merchandise, baggage, and clothing proceeding from the infested places, without any necessity for the presence of any diseased person. Thus we find that only one steamer arrived during the epidemic at the Port of San Blas from Mazatlan, on the 20th of August, 1883; she did not have any case of sickness on board either on leaving the port or during the voyage, nor did she have any during the first days of the quarantine to which she was subjected; but the quarantine was broken, the owner of a hotel in the port and some of his guests went to take supper on board of the "Naufrago," and returned on shore, carrying with them this terrible disease, to which they themselves succumbed as well as the other guests and servants of the hotel. The disease spread with astonishing rapidity throughout the rest of the town, but did not attack anybody either in the crew or among the passengers of that ship, they being allowed to land when the town was found to be infested. These passengers composed the chorus of an opera company under the management of the famous Mexican singer, Angela Peralta, who had already been carried off by the fever in Mazatlan, as well as the director of the orchestra, Pedro Chavez Aparico, and other individuals in the company. In order to combat the epidemic, the city councils adopted the plan of burning sulphur in the streets and houses, as well as large bundles of wood in the places where the bodies were buried, but in spite of these precautions we had several cases of the same fever in the summers of the following years, 1885 and 1888.

The reason why the yellow fever does not last on our Pacific coast is at present the object of scientific study, as well as the laws that govern the storms and currents of wind. Careful studies have been made by Siemens, which have been further developed by Dr. Perfner, of Vienna, and which entirely destroyed the theories of Dove, with its trade winds, that we were taught in the schools, and the subsequent theory of Buye Ballot, which rests on the differences of barometrical pressure. A quarter of an hour's time is too short to enter into a study of the details of this matter, which is further explained in the journal of the Supreme Board of Health.

On this coast we do not find any cases of serious diphtheria or croup, and the few cases that are observed are so mild as to be even doubtful. Neither do we have any typhus nor typhoid, in spite of the execrable system under which we get rid of the night soil, and which consists in digging a hole in the ground deep enough to reach a layer of porous and absorbent matter, which is called "Jal" and which is found at six to eight metres below the surface. In these holes all the refuse matters of the houses are deposited without any ventilation or precaution whatsoever, and when the hole is filled up another one is dug in the same manner and filled in an equally primitive fashion. On this point I have made a careful study, and will soon present a scheme for the construction of proper closets to the Supreme Board of Health.

In all this district wounds are cured with the most astonishing rapidity and facility, it appearing as if the atmosphere were entirely aseptic, and almost all surgical operations are successful, but we always have to fear the terrible tetanus, which is vulgarly but expressively called "arch sickness" on account of the form which is sometimes assumed by the body of the sick person, who raises himself in his bed and rests only on his heels and occiput, owing to the rigidity incidental to the disease.

This terrible complication which follows wounds, always kills the persons whom it attacks, except in a few cases, when the patient survives through a simple hypodermic injection.

The sting of a scorpion, which every year kills three or four of the country laborers, produces symptoms similar to tetanus. The introduction of painkiller has often saved persons bitten by scorpions, when it has been applied at the moment of receiving the sting, but in real tetanus this medicine has no influence or effect whatever.

Smallpox commits great ravages on this coast in those places where vaccination has not been administered on account of the ignorance of the people; even at the present day many people vaccinate their children only after a great deal of labor has been expended in convincing and obliging them, and it is to be noted that the persons who have not been vaccinated almost invariably die when attacked with the disease.

The vaccine lymph decomposes and loses its virtue with great rapidity on this coast, due probably to the damp warmth of the country, and it is therefore necessary to vaccinate from one arm to the other, or with lymph that is freshly received from Mexico city, as that which is collected on the coast cannot be depended upon in spite of all precautions. Nor can we depend upon that which is received from San Francisco, California, or New York, as it has been proved by practice that the only lymph which gives good results is that which is received directly from Mexico city.

In order to preserve the vaccine during the year that I have been practising in the territory, I have been under the necessity of continually keeping children under vaccination by operating from arm to arm, and paying for that privilege.

Tuberculosis is, comparatively speaking, very infrequent in this district, especially comparing the statistics of our coast with those of the Atlantic; but on the other hand any victims who fall under that disease are killed with terrible rapidity.

The Mal del Pinto, known under the name of "tiricna," is not so common on this part of the coast as on that which is comprehended by the states of Guerrero, Oaxaca, and Chiapas on the same ocean. The ignorant cure it by bathing in sulphurous thermal springs, which are found in different parts of the country, and by means of which they procure a temporary relief.

On this point it is curious to observe that some persons whose skin is naturally of a very dark color, undergo a complete change of color and become albinos, and if they have children, some of these are entirely albinos and others dark. Is this a combination of the vitiligo with the Mal del Pinto?

We also find on this coast, although only in rare cases, a few instances of leprosy, in its three forms, and it is successfully treated, detaining and modifying its advances, with oil of Ginocardia. The drinking waters throughout the territory are generally of excellent quality and abundant.

In the city of Tepic it would be easy to supply its necessities by means of piping, and a very imperfect earthenware pipe does exist for the supply of the two small fountains which ornament the principal square, but it would be perfectly practicable to carry the water to all the houses at a cost of eight to ten thousand dollars, according to the estimate of a well known engineer. In this way we would secure an important protector against paludism, as the water which is in a position to be brought into the city is found on the higher elevations of the neighborhood.

As an army physician I was present at the epidemic of cholera-morbus that attacked the Isthmus of Tehauntepec at the end of the year 1882 and beginning of 1883, and it was due to the reports presented by myself and colleagues that sanitary guards were placed around the infested districts, and the epidemic was stamped out.

In conclusion I present a table of the mortality caused by the epidemic of Asiatic cholera in the year 1850, showing a total of 873 cases out of a population of 35,000 inhabitants that at that time lived within the municipality. It is to be remarked that both in this epidemic and that of the year 1823, which were witnessed by many persons who are yet alive and in perfect health, the disease appeared to be most violent on the women and to have some respect for the men, this being entirely contrary to what happens with yellow fever. It is also to be noted that the cholera epidemic of 1850 caused fewer deaths than one of the grippe, which appeared about ten years ago and which was called "El Tonto," because it only attacked the poor people. These diseases always commit their ravages among the people who do not observe the laws of hygiene.

XV.

A FEW WORDS ON TAMPICO AND ITS MARSHES.

By A. MUTIENZO.

Tampico, Mexico.

GENERAL ETIOLOGY.

The dominion of marshes can be called universal. Thus it seems that the paludal germ finds everywhere the necessary conditions for its life and growth, those regions where it is not found being quite exceptional. In our country, according to Dr. Ruiz, it is the dominating endemic, more especially in the extensive stretch of low lands bathed by the waters of the Gulf of Mexico, and showing itself also, though with less intensity, in many towns of the central plateau, in spite of this being more than 1,000 metres above the level of the sea and under the climatic conditions of cold climates.

Heat, humidity, and vegetation are the requisites for the development of miasma or at least for its vigorous growth, as can be seen in all that part of the country, called the hot country, where, in effect, to a tropical temperature are united an excessive dampness of air, a soil of alluvion and marsh, and exuberant vegetation.

Let us be permitted to insist on the disputed question of marshes, for even accepting the telluric theory, the pathogenic influence of standing water, now forming extensive pools of miry water, now infiltrating the soil, and more or less exposed to evaporation, the result of secular observation is, in effect, that the most paludal places, those where the germ prospers in all its strength, are essentially marshy, formed of low, damp lands; the west coast of Africa from Senegal to Cape Lopex; Lower Egypt, with the valley of the Nile; in America, the states of Texas, the maritime zone of Louisiana, the marshy plain of Tazro and the Mississippi, the bay of Mobile. In Mexico, the paludal zone of the hot country, formed of sand and feverish marshes; Tampico with its lakes with marshy shores, its low lands, submerged by the overflow of the rivers; Veracruz with its pools and morasses of Tejeria, and its low, damp lands to Soledad. Finally, as an example of paludous soil we will cite Cologne, in France, distinguished for its marshy soil and for its notorious unhealthiness; and also Dombes, with its reservoirs covering a space of 2,000 hectares, where the inhabitants of the convent of La Frappe are changed every four years, victims to the fever and their sublime abnegation.

TOPOGRAPHY OF TAMPICO.

The town is situated about 6 or 8 metres above the level of the sea, in its most central part, and the rest is on the sea level; it gives a census of 8,046 inhabitants, including the outskirts, or it might be called 9,000 to be nearer the truth. It is on an alluvial soil with a clayey, impermeable sub-soil. Its streets are straight, running from N. N. E. to S. S. W. and from E. S. E. to W. N. W.; its houses, of one story, are spacious and, thanks to the width of the streets, constantly receive the rays of the sun, which dispel the moisture and make rheumatic affections less frequent, being so numerous in the great centres of towns. Its hygienic conditions are of little interest; the houses have large open spaces in the centre and good ventilation, and also the detestable system of permanent fosses, which, however, is compulsory from the absolute want of drainage.

Rain water, collected in tanks, is what is used in the centre of the town, and it possesses all the character of a good drinking water; purity, lightness, and no taste or smell whatever; and the excellent construction of the tanks must be taken into consideration, their impermeable walls of stone and Roman cement, which prevents any contamination from the earth; and the precautions taken in collecting the water and the periodical cleaning of the cistern and channels to prevent any infection from the outside. The other part of the city is supplied with water from the river Tamen from a great distance; it is also drinkable and very clear, but without the lightness and limpidness of the rain water.

With regard to the topographic conditions we will point out the checking of the waters, forming marshy pools in the streets and court-yards of the houses or in fields in the neighborhood of the lake "Carpintero;" this is most noticeable in the high tides and in the rainy season. They are to be found on the margin of the said lake, from "Cortadura" to the extreme north of the town. All that belt of low lands, alternately submerged and marshy, is, to our way of thinking, one of the principal paludous foci, which surrounds the city. On the west side another great stretch of land is watered by the river "Tamesi," and suffers, at the same season, inundations, which place it in the same deplorable condition that we have shown, thus powerfully contributing to the notorious unhealthiness of the town. Finally, on the S. and S. E. there are still, though in smaller proportions, places at times inundated, of rich vegetation, that contribute with the others to make Tampico one of the first, if not the first, of the palustral foci of our soil.

CLIMATE AND METEOROLOGY.

Tampico is situated on the northern extreme of the torrid zone, and in that part of the shore called the hot country and characterized by its low level, by its sandy and alluvial soil, by its exuberant vegetation, and by its extensive lakes and marshes. The year may be divided into two seasons; that of the rains and that of the northern winds; the first from May to September, and the second from that time to April or May. The first

season does not present such marked limits and could well be sub-divided into two epochs: one of slight and the other of heavy rains, separated by the hottest and dryest months. The season of north winds is always more exact; it begins to show itself from September and becomes well marked from October to the rainy season.

WINDS.

During the winter, part of autumn and spring, the dominating wind is N. N. E., preceded by the S. and S. E. winds, with a decided lowering of the barometer, excessive humidity in the air even to saturation in the mornings and nights, and dense fogs from the S. and S. W. In the warm season breezes come from the E. and S. E. during the day, W. and S. W. land winds at night and early hours of the morning.

TEMPERATURE.

Summary of observations of temperature in the year 1891 which gives a sufficiently exact idea of the usual temperature:

First Third of the Year (medium temperatures; season of north winds).			Second Third of the Year (medium temperatures; season of heat and rain).			Third Third of the Year (medium temperatures; end of rains and commencement of north winds).		
Medium.	Maximum.	Minimum.	Medium.	Maximum.	Minimum.	Medium.	Maximum.	Minimum.
20.9	24.5	17.4	27.0	30.6	24.1	22.6	26.7	19.2

Absolute maximum of the year: 33.3 (July).
Maximum: 7.7 (November).

GENERAL AND PALUSTRAL MORTALITY.

Population, according to the last census, 8,046 inhabitants; today, owing to the railways and the work of the canalization of the bar, it probably reaches 9,000, so that on this number are based our calculations.

Year 1890.

Deaths in all the year,	460
Do by railway accidents, wounds, etc.,	20
Annual mortality per 1,000,	47.1
Deaths from paludous fevers,	150

Year 1891.

Deaths in the whole year,	623
Do by railway accidents, wounds, etc.,	22
Annual mortality per 1,000,	66.7
Deaths from paludous fevers,	212
Mortality per 1,000,	23.5

The noticeable increase in the number of deaths compared with previous years is due to the epidemic of influenza in May, and also to the floating population for reasons indicated.

TABLE

Showing the principal causes of deaths that took place in 1891.

Months.	Palustral fevers.	Pneumonia influenza.	Tuberculosis.	Dysentery and enteritis.	Hepatitis.	Palustral cachexy.
January	8	7	6	2	2	2
February	2	6	2	1	..	..
March	8	2	5	1	1	1
April	1	8	4	1	..	2
May	19	39	11	4	1	1
June	11	9	9	1	3	3
July	16	9	7	5	..	3
August	29	4	4	4	1	2
September	29	4	3	8	2	1
October	23	4	2	9	3	3
November	20	7	5	5	2	4
December	21	10	4	6	3	3
Totals	187	109	62	47	18	25

Such a high rate of mortality occasioned by malaria is observed principally in infancy, from the ages of three months to two years, owing to a predisposition on account of cerebral complications at that age, and to the little use of quinine, because the poorer classes have a rooted prejudice against the only specific of paludous fever, which is shared by many people of a higher social grade.

PALUSTRAL MORBIDITY.

There are no words to express it, nor figures to count it; those who have the good fortune to escape the malarial infection are noted exceptions. Sooner or later one must suffer its attacks, until one is acclimatized; it shows itself, however, with more intensity, in recent arrivals, especially if they come in numbers, like troops or workmen.

Number of Patients from paludous fever entered at the Military hospital in 1887.

(*Endemic epidemic on the arrival of the 14th Battalion.*)

January,	65
February,	58
March,	108
April,	112
May,	154
June,	472
July,	536
August,	620
September,	26
October,	35
November,	28
December,	17
Total,	2,421

TABLE

Showing the number of patients from paludous fevers entered at the Civil hospital in 1891.

Months.	Intermittent.	Remittent.	Pernicious.	Anæmia and cachexy.
January	21	8	1	3
February	15	..	2	..
March	14	2	1	..
April	19	1	1	2
May	22	1	2	1
June	101	2	3	3
July	130	11	1	1
August	134	6	4	2
September	122	3	1	3
October	80	1	7	6
November	57	1	2	5
December	53	..	2	1
Totals	768	36	27	27

FORMS.

Palustral endemic suffers here, as is the rule in other countries, recrudescences in its manifestations, generally estival, taking in such case an epidemic character. The first rains of the spring falling on a dry, broken soil, are rapidly absorbed, thus preparing the land for the elaboration of the germ; it is, one can say, the necessary watering for the

prosperity of the mysterious flower of paludous fevers. The heavy showers at the beginning of summer, followed by a tropical temperature evaporated by the rains, put the soil in the best condition for the endemic epidemic so common in this season. Of the multiple forms affected by malaria, the daily *intermittent fever* is the most frequent, showing itself with its three different periods; chills, fever, and perspiration, the two last constant, and the first, if present, passed over on account of being little noticed.

Tertian fever is seen much more seldom than the above form; it is always accompanied by prolonged chills; the stage of perspiration is more constant and pronounced, and is considered an indication of advanced poisoning, as it shows itself generally in those who, at some more or less remote period, have suffered other attacks of malaria.

Less known still, we only having notes of four cases, is the *quartan*, which, as is well known, is more frequent in temperate or cold climates.

Besides these regular manifestations, there are the *pernicious* fevers, which, we believe the hœmatozoon being the same, are the former forms, modified by the conditions of the soil or are individual forms according to their development. And it is easy to think so, seeing the extreme gravity of paludous fever in early childhood, an access of simple intermittent terminating in death, and bearing the character of cerebral pernicious meningitis. It is evident that the nervous susceptibility usual at that tender age, has been the cause of such malignity; and we believe the same in serious cases of adults, always depending on the soil where the germ was sown, thus corroborating once more the true axiom of Peter, "*chacun fait sa maladie à sa facon.*" Of all these pernicious manifestations, the first, from its frequency, is the *cerebral* with apoplectic ictus and all the symptomatical accompaniment of a very intense congestion. More rare are the *delirious*, the *coleric*, the *algid*, and the *diaphoretic*, and they do not offer any symptom that is not already known or that merits any special notice.

In the acute forms, sudden in their appearance and of short duration, we find the extreme group of the *pseudo-continual* and palustral *remittent;* we will not insist on the hybrid remittent or malarial typhus which lasts two or three weeks, and is not influenced by quinine; a form not very common and sometimes ceding to balneotherapy.

Remittent, or rather pseudo-continual that we most frequently meet with, is *continual* of three to five days, an ephemeral species peculiar to temperate climates, which would be clinically difficult to classify, if it were not for two characters of supreme importance: the presence of hœmatozoon and the relapse under the form of free intermittent. We do not advise the use of quinine, which does not affect the ephemeral, and leaves in the mind the doubt whether the fever we are curing would be cured *in spite of the quinine*, it being an ephemeral fever.

The remittent that after the latter is most commonly observed, is the one of seven days, with the sole symptom of hypersthenia, sometimes, but not constantly, a splenic pain, vomiting, and cephalalgy. And the same

remittent fever of two or three weeks, without indications of localization, and characterized only by the return of the fever. Quinine in all these prolonged pyrexias does not show itself the heroic remedy as in all other forms; its administration continued as far as to produce quininism does not appear to arrest the progress of the illness, although it has a favorable influence in the final result, as we have observed on seeing these fevers badly treated or neglected.

The bilious remittent with the jaundice that accompanies it, and with the characteristic defervescence after the first day, is less common, showing itself with persistent bilious vomiting, and rather under the form of a gastric febril affection.

LARVAL FEVERS.

Proligerous manifestations with little or no febrile reaction in mild forms, are truly hypertonic in serious cases.

NEURALGIC FEVERS.

The most common above all is the supra-orbital. Sometimes it follows a simple intermittent or precedes it, accompanied then by a light febrile ascension and sediment in the urine; it cedes admirably to quinine in connection with morphine.

CONGESTIVE FEVERS.

Fluxions of the mucoses: coryza, pharyngitis, conjunctivitis. A type of these forms is the *phlyctenular intermittent conjunctivitis* as a most notable case that we have observed: ardor and intense injection of the conjunctival zone where the phlyctæna forms: spontaneous and gradual disappearance of all the symptoms with the same rapidity with which they appeared.

PNEUMONIC FEVERS.

Does intermittent pneumonia really exist? Tartenson considers pneumonia *always* of palustral origin; showing itself, according to him, by the increased mortality, which is attributed to pneumonia, a mild illness (?) more likely due to larval pneumonic fever, as is besides proved by the efficacy of quinine in serious cases. Such an idea makes one at once believe that larval pneumonic fever shows itself like a palustral manifestation even more dangerous than the pernicious forms, in places where these are unknown and which are not propitious to the growth of malaria.

We believe for our part, that the palustral pneumonia has no separate existence like common pneumonia, which is an infectious and epidemic disease of determined duration, being rather an *intermittent fever* with *pulmonary manifestations*, as it could have been cerebral or intestinal; it is an intermittent fever associated with "an organic determination that it has under its dependence" (Jaccond), or "an intermittent fever accompanied by pneumonic" (Grasset). As to the pneumonia of those affected of palustral cachexy it does not give room for discussion; it is ephemeral

pneumonia well developed in worn out constitutions, which offer well prepared ground for the growth of the pathogenic germ.

PALUSTRAL CACHEXY.

Among the lowest classes where, united to deplorable conditions of life, there is an invincible repugnance to quinine, and it is not strange that palustral poisoning should reach to its last point: anœmia, œdema, diarrhœa, and enormous splenic inflations.

Chronic diarrhœa or palustral enteritis is the most frequent cause of death among these unfortunates; it is common to find in the corpse, beside intestinal splenic wounds, cirrhotic degeneracies of the liver and kidneys.

Palustral anœmia, without splenic hypertrophy characterized by the pigmentosus color of the skin, by the apathy, physical as well as intellectual, and by a badly characterized union of symptoms, presented with intermittent and precursors very often of an open manifestation, it can be seen in the greater number of the inhabitants, and constitutes latent paludous fever, the most general form of palustral poisoning.

XVI.

THE COLLECTION, REMOVAL, AND DISPOSAL OF GARBAGE AND DEAD ANIMALS AT ST. PAUL, MINNESOTA, U. S. A.

By HENRY F. HOYT, M. D.,
Commissioner of Health.

Gentlemen and Ladies: I believe it is sometimes customary, in commencing a paper of this kind, to announce that the subject under consideration is the most important one in the entire range of sanitary science. While I shall omit the "customary," I must confess that during the period of over six years of active, practicable, sanitary work as executive officer in the department of health in the city, I have the honor to represent that the one bugbear, the nightmare of the health officer's dream, the most vexatious, irrepressible, apparently never-to-be-overcome or settled problem, was that which adorns the title page of this manuscript,—"The Garbage Question." All things, however, must come to an end, and our natural persistency, obstinacy, and perseverance have at last been at least temporarily rewarded, and I shall take great pleasure in describing to you as plainly and briefly as possible the details of the system now in operation in our city, which is the result of a number of years of investigation, experimentation, and toil in this special direction. Not that I have anything new or novel to offer, but more that I may get the benefit of your criticism and suggestions during the discussion that I hope may follow the reading of this paper, is my apology for its presentation.

COLLECTION OF THE GARBAGE.

In about one quarter of the area of the city, the most populous portion, the collections are made daily between the hours of midnight and nine o'clock a. m. The remainder of the city is provided with a tri-weekly service, at any hour that suits the convenience of the contractor. The entire work of collection, removal, and disposal is done by contract by one company. The people are required by law to provide suitable and proper receptacles for their garbage, which must not be too large for convenient handling, must be made of either hard wood or some metal (preferably galvanized iron), must be tightly covered, cleansed and disinfected at regular intervals, and must be placed or kept at a point on the premises most accessible to the scavenger. The law also provides as to what shall constitute garbage. No ashes, sticks, stones, etc., are allowed to be put in with the animal or vegetable matter, the

one exception being tin cans. For persons violating the provisions of this ordinance the penalty of a fine is provided. The garbage is emptied from the receptacles by the scavenger into hard-wood casks of a capacity of about forty-five gallons. Five or six of these constitute a one-horse load, and in the districts where the double teams are used ten to twelve are carried. These casks are provided with hard-wood covers by which the casks, when filled, can be hermetically sealed by means of an iron rod attached to the bottom of the cask, extending up the center through the lid, and being provided at the top with a powerful hand-screw. These casks, when filled, are carried to a convenient location, loaded into box cars, transported into the country some fifteen or twenty miles, there unloaded, and the contents put through a system of reduction that converts them into a fertilizing material. The casks are then thoroughly cleansed and returned to the city for another load, the entire system, from the time the casks are filled at the homes in the city till they are emptied twenty miles away, being absolutely free from unpleasant odors or anything that could be construed into a nuisance.

DEAD ANIMALS.

These are collected in a kind of covered wagon constructed for that purpose, conveyed to the train, transported to the same location as the garbage, and there rendered into tallow, fertilizers, etc. The company doing this work have selected a very barren piece of land for their works, and are expecting in the course of time to have it blossoming like a rose.

THE DISPOSAL OF GARBAGE.

Some of you may wonder why we ship all this material twenty miles into the country. I will try to explain. During the past six years I have read many reports and descriptions of many different systems for the disposal of this refuse material; travelled many miles; personally examined, tested, and inspected many plants, crematories, and systems relating to the subject; have listened to a number of long, learned, and interesting papers, as have members of my patient audience, upon the same subject, that have been presented to this honorable association at various times, nearly all of them endorsing one system or another as being almost perfect for the purpose intended, a system that could be operated in the heart of any city at any time without being a nuisance. In fact, from *some* of the descriptions one could almost imagine that he would gladly pay a bonus to be allowed to erect a home in close proximity to one of these garbage plants, so flowery and free from nuisance, and such adjuncts to health are they. Gentlemen, did any of you ever undertake to run one of these garbage perfume manufactories in the heart of a city? I have, and dismally failed. If any of my audience have succeeded in accomplishing successfully, without strong opposition, the maintenance of a garbage crematory or reduction plant in a populous

neighbôrhood, I will be under lasting obligations if they will inform me how it can be done.

It is *my* candid and honest opinion that there *are* one or two systems that are nearly all that is claimed for them. Yet I would earnestly advise that while you may *claim* for them everything in sight, if you are thinking of locating one in your respective location, go just a little way out of town with it. Why is this? My experience has taught me to believe that the nomenclature is wrong. You attach the word "Garbage" to a bran new, empty, covered wagon, allow it to stand on a street in a thickly populated district, and I firmly believe that in a very short time a large per cent. of the adjacent populace would be under medical treatment or threatened with some dreadful pestilential disease, the air would be full of petitions to the health department, injunctions, threats, etc. This is not overdrawn, for I have witnessed just such an absurd performance as I have described. So, until the names can be changed, dispose of your garbage and refuse material on the outside.

COST OF THIS WORK.

The scientific sanitary expert, laboring and toiling as he does, devoting his life's work to the noble and unselfish effort of endeavoring to improve the condition and prolong the lives of his fellow-beings, has very little opportunity or leisure to pay any attention to the actual cost in dollars and cents that the practical application of the result of his studies and researches entails. That part is left to the health officer, who, between his knowledge of what he could do, and what *ought* to be done had he but the *ways* and *means* on the one side, and the often too meagre appropriation that is grudgingly doled out to him by those in power on the other, is in a position that is often not enviable. But I am digressing. Our city has a population of 150,000. There are 20,000 houses from which garbage is collected, to accomplish which over 350 miles of streets have to be traversed. It is estimated that we have 75,000 tons per annum of all kinds of refuse. Of this 15,000 tons is refuse and dead animals, or about fifty tons per day, estimating 300 working days in the year. To collect, remove, and dispose of all garbage and dead animals from our city in the manner I have described costs $1.51+ per ton, or about 15¢+ per capita per population per annum, the contractor being paid at the rate of $22,700 per annum. The contractor is required to furnish, under oath to the department of health, a monthly report that must state the name of each street, number of each house, and the number of calls made at said house during the month. If he fails to remove the garbage after being properly notified, and complaint is left to that effect at the department of health, he is fined twenty-five cents for each and every such complaint. If one hundred complaints come in, the council have the right to cancel the contract should they so desire. The entire work is under the direct orders, control, and supervision of the department of health.

XVII.

DRINKING WATERS FROM THE CITY OF CHILPANCINGO AND HYGIENIC RULES FOR USING THEM.

By Dr. LEOPOLD VIRAMONTES.

Gentlemen: The small work which I have to-day the honor of presenting to such an illustrious body I have divided into three parts: the first treats of drinking waters in general, the second of the drinking waters of the city of Chilpancingo, and the third of the hygienic use of the said waters.

In the first part, as also in the third, you will find ideas well known to all of you, for I do not present any novelty in my dissertation, my only object in submitting this work to your approbation being that, once accepted by such an assembly, it can be distributed among the inhabitants of the city of Chilpancingo, to serve them as a guide or instructor; that they may have within their reach the most necessary data for the knowledge of the waters that they use daily; that they may know to which of these they ought to give preference, and the means at their disposal for purifying them. Having given this indispensable notice, I enter on my subject.

I.

DRINKING WATERS IN GENERAL.

Water is the most scattered element in nature, its composition being the same from whatever place it springs. It is formed of oxygen and hydrogen, always in the same proportion, viz., 2 volumes of hydrogen to 1 of oxygen.

In its solid state it is ice or snow; in its liquid state it covers three quarters of the surface of the globe, forming the oceans, seas, lakes, rivers, brooks, etc., and in the state of steam it forms part of the atmosphere, and when taking a particular form called the nebulousness, it constitutes the clouds. The waters which come from rain, springs, rivers, streams, etc., have in solution or in suspension some of the elements that constitute the soil through which these waters pass. These matters are infinitely varied, but those most commonly found are carbonate and sulphate of calcium, chlorate of sodium, salts of magnesia, something of silica, and also very small quantities of iodine and of phosphates. Organic matters are also found, especially in still water, like marshes.

These waters also contain a sufficient quantity of air and carbonic acid, this last gas being that which maintains in solution the alkaline carbonates in the state of bi-carbonates.

Water to be drinkable ought to unite the following conditions: It must be clear, without odor, light, of a fresh and agreeable taste, able to dissolve soap without making grumes, to cook vegetables without hardening them, to have in dissolution a sufficient quantity of air and of carbonic acid, as also of mineral matters, and it ought not to contain organic matter. These last conditions can be proved by means of heat, for if the water contains sufficient air, it is hardly warm when it gives out gases, and if it evaporates completely, it will leave a residue formed by fixed matters, which, if it presents a black color, proves it to contain organic matter. Neither the color nor the taste nor the smell, and often not even a chemical analysis, are enough to distinguish good water from bad. For this the best proof we can take is the living being, for when animals and vegetation of superior organization can live on certain water, we have the certainty that this water is healthy; but if, on the contrary, the said beings die, it is because the water is infected. For example, when water changes, the fish it contains rise to the surface and die.

With vegetables the same test can be made, for the existence of some, such as the water-cress, shows the good condition of the water, whereas the presence of others, such as the sweet-water wrack (alga), proves its bad sanitary condition.

The waters which contain sulphate of calcium are called selenytous ones: they do not cook vegetables well and are difficult to digest, and consequently irritate the digestive organs.

Bi-carbonate of calcium, on the contrary, makes the water more agreeable and easier to digest, and as this salt decomposes in the stomach the carbonic acid is free and stimulates the walls of the said organ, and the lime supplies the elements for the growth and vigor of the bones of the skeleton.

II.

DRINKING WATERS OF THE CITY OF CHILPANCINGO.

Many are the springs which surround the city of Chilpancingo, and on every side they are seen to flow, now from the bed of some stream, now from under a rock, or even the surface of the ground—all from different heights, and many of them losing themselves after a short space, to spring out again a few metres further on.

The principal of these springs are the following: "La Nuez," to the east of the town and 1,000 metres distant from the principal square; "La Virgen," to the south-east and at 3,500 metres; "Atonzahuilco," to the east and at 2,500 metres; "Las Alcantarillas," at 4,000 metres; "Atlitenco," which unites with "Jalagüacingo" at a short distance, to the north-east at 1,000 metres; "El Caracol," to the north-east at 700 metres. There are a few other springs, like "Ahuehuete," or "Sabino,"

"Los Ahuejotes," "Los Ameles," and others, but they are of little importance.

Up to now, only the waters of "La Nuez" are conducted to the centre of the city by two pipes. one of iron and the other of masonry, both running in a parallel direction to two public fountains situated in the principal square. From the main pipes there are branches, which conduct the water to private houses and to four more fountains, one situated in the central square, another in the "Chapitel," and two in the "Bravo" garden.

The quantity of water given by the springs of the "Nuez" is sufficient for the requirements of the town, but more than half that reaches the city is wasted for want of a proper system of locks. The distribution, on the other hand, is deficient, for only 35 houses receive water by pipes, and though the population is small (6,500 inhabitants), one can see at once that a great number of houses are without this advantage, and the residents have to make use of the wells existing in the interior of their habitations, or of the public fountains, which are at a great distance from many of them.

As the city does not possess a laboratory wherein to make chemical analysis of substances, I have only been able to make qualified analyses of many of these waters, obtaining the following results:

Springs of "La Nuez,"—Qualified Analysis.

1. With lime water it gives a white precipitate, which indicates the presence of carbonic acid.
2. This water boiled and filtered gives, with lime water, a white precipitate that indicates the presence of magnesia.
3. The natural water with oxalate of ammonium gives a light white precipitate that indicates the presence of salts of calcium.
4. With chlorate of barium, acidulating the water with chloridic acid, it gives a decidedly opaline color, indicating the presence of sulphates.
5. Acidulating this water with nitric acid, it gives a white precipitate with nitrate of silver, soluble in ammonium, indicating chlorates.

With the waters of "Atonzahuilco" and "Alcantarillas" I obtained the same results, but the analysis of "Jalagüacingo" gave me the following results:

Springs of "Jalagüacingo" and "Atlitenco."—Qualified Analysis.

1. With lime water they gave a precipitate that indicated the presence of carbonic acid.
2. With oxalate of ammonium they gave an abundant precipitate, indicating the presence of calcium salts.
3. The water boiled and filtered, with lime water gave a light white precipitate, showing it contained magnesia.

4. These waters, without being boiled or filtered, but acidulated with nitric acid, gave a light precipitate with nitrate of silver, soluble in ammonium, indicating the presence of chlorates.

5. With chlorate of barium, and acidulated with chloridic acid, it did not give any precipitate.

This same result was given by the analysis of the springs of "La Virgen," "Tlacolotlán," and "El Caracol," by which can be seen that the waters of the first analysis contain sulphates, the sulphate of calcium predominating, for they have all the character of selenitic waters; and the waters of the second analysis contain carbonates, particularly carbonate of calcium, making these waters preferable to the first for the use of the town. Many of the inhabitants even now send to these springs for their drinking water, for that taken from the public fountains often deranges the digestive functions. But of these springs those preferred are the nearest, like "Atlitenco" and "Jalagüacinco," which, joined to their excellent quality, have the advantage of good ground for laying pipes which could conduct the water to the square of "Chapitel."

The pipes from the "Nuez" could still be left, for besides being beneficial to some persons on account of special circumstances connected with their digestive organs, these waters can be purified by using means of which we will speak when treating of hygienic rules.

In this way there would be sufficient water to supply the town, and the inhabitants will have the opportunity of choosing the water that best suits their digestive functions.

The conduit of water, once established,—and I take the liberty of recommending this as indispensable,—should be of iron; the one of masonry now existing ought to be destroyed, this system bringing bad results to the hygiene of towns.

There are also in the city a great number of wells, which are used by the inhabitants because the public fountains do not suffice, but when the town is supplied from the springs in the manner we have indicated, the said wells should be filled up, as well as precautions taken that the people should not drink water from the holes or pools on the banks of the river "Huacapa," for the use of this water is dangerous to the health.

With the object of making better known the classes of water that can be found in the locality, I give here an idea of the composition of the ground, which consists principally of sulphate of calcium, granite rocks, marble, gneiss in extensive beds, yellow earth of oxide of iron and peroxide of manganese, carbonate of calcium, and vegetable earth.

III.

HYGIENIC RULES.

Having given the conditions necessary for water to be drinkable, we will occupy ourselves with its origin, its distribution, and its purification. The waters which come from tanks, lakes, and pools are not

drinkable, because they are charged with organic matter in decomposition, and, besides having a bad taste, they produce inflammation of the digestive organs. Before using these waters it is necessary to filter them, and then agitate them that they may mix with the air, adding to them a small quantity of bicarbonate of sodium or kitchen salt; or it will be sufficient to boil the water and add the salt.

Rain water is pure, but it must be caught before reaching the ground, and the first rain must not be used, as it contains organic matter. Water obtained from melting ice must not be used, because it is wanting in salts and has not mixed with air.

The waters from wells vary in character according to the soil they pass through, but their use ought to be avoided because they generally mix with substances which dirty them and make them dangerous, owing to the filtrations received.

The waters from tanks are generally charged with organic matter, and also contain calcareous salts, proceeding from the walls of the depositories, so that before using them it is necessary to boil them.

The waters from artesian wells ought to be made cold and mixed with air in the fountains destined to receive them.

The waters from rivers, streams, and even those that run in channels, ought to be avoided, for they are polluted with the impure water used in domestic duties and industrial establishments.

The water of deep rivers, but especially that from springs, is the one that ought to be preferred before any other for the uses of life, because it unites all the best conditions for public health.

As to the distribution of water, we will only say that it ought to be conducted to the public fountains and houses by means of pipes, which ought to be of iron, and care ought to be taken that the fountains and deposits where it is received should be constantly cleaned, so that no organic matter or calcareous substances can accumulate and make it unhealthy.

To conclude, we will speak of the *purification of water*, a most important topic in this study, because it depends on purification whether we can use water without danger to one's health.

Water requires constant analysis and especial, though simple, treatment for us to drink it without risk. This is the vital problem which is now engrossing the attention of many cities in Europe, particularly of those who drink river water.

The sanitary police take care that meat, fruit, wine, and all other nourishing substances should be wholesome and good, and punish those who sell them in bad condition, but the same police give themselves no trouble about water, which is the substance most consumed. And water, particularly that of rivers passing through cities and towns, is the surest medium of fevers, cholera, and of thousands of infectious diseases.

The scientific chronicler, Henri de Parville, says that not long since he analyzed various quantities of water from that used by the public in

Paris, and found colonies of thousands of live germs, microbes, and their companions of the invisible world.

Even the custom of taking drinks cooled by pieces of ice can be hurtful, because a block of crystalline ice, pure and beautiful in appearance, may contain the same infectious matter as the water from the river or well from which it was made.

What can be done so that water may be used without any danger? Purify it.

The purification of water can be obtained by means of *repose*, in order that the suspended matter—heavier than water—should be deposited at the bottom of the vessels containing it, or through a porous substance, detaining the matter that the liquid may contain in suspension.

To-day the filters of Pasteur, simple, economical, and convenient, are known and used abroad, and even in our country are becoming general. In the barracks and colleges of France they are used successfully, cases of illness among the numerous residents being less frequent.

Would that among us this preservative contrivance became more common: it should be a powerful auxiliary to hygiene. The authorities should bear in mind that an urgent means of preserving the health in towns, for obtaining abundance of water and its purification, is the planting of trees, commencing around the springs, to obtain in this way the re-population of the woods. The vegetation that in other times descended from the neighboring mountains into the city of Chilpancingo, till then covering with its luxuriance the roofs of the houses, has been retiring, and is now at a great distance from the town, owing to the felling of trees. For this re-population of the woods, trees ought to be chosen like the ash, *Fraxinus pubescens*, and the *schinus molle*, a Peruvian tree, which have thick foliage, and are not attacked by insects, having also the advantage of being propagated by seed and slips.

CONCLUSION.

1. The waters of the springs of "La Virgen," "Atlitenco," and "Jalagüacingo" are those which unite the best conditions for the use of a town, the last two to be preferred for their waters to be conducted into the centre of the town, the two in reality being only one.

2. Of the two conduit pipes now existing, the one of masonry ought to be destroyed, keeping the iron one, for though the water it conducts is charged with sulphate of calcium, it nevertheless is of great service to the town.

3. The re-population of the woods should be proceeded with at once, for it is now a scientific principle that trees preserve the regularity of rain and maintain the flowing of drinking water.

4. Wells ought to be filled up, particularly those of little depth, whose waters are bad for health.

5. Public fountains ought to be conveniently substituted, in order to avoid wasting and contaminating the water.

6. A laboratory ought to be established for chemical, microscopic, and hydrotimetric analysis, so that the authorities and the public may be informed whether the water that is used in the town for domestic purposes is really drinkable, or contains elements hurtful to the public health.

This is what we can now condense in these notes, which, doubtless, are insufficient for the object to which they are dedicated; but, on one side our intellectual faculties, and, on the other, having to comply with the regulations of this Association in its seventh article, oblige us to measure our time and give to this humble work narrower limits than we would desire.

XVIII.

IN COUNTRIES UNDER A FEDERAL REGIMEN, CAN AND SHOULD THE UNION EXERCISE ANY INTERVENTION ON SANITARY MATTERS? IN WHICH CASES AND HOW FAR, CAN THIS INTERVENTION BE EXERCISED?

By JOSE M. GAMBOA, Esq.

Gentlemen, Members of the Congress: The thesis that for reasons that I do not think necessary to refer to has been entrusted to my insufficiency, requires as preliminary a clear definition of what is understood by *federal regimen*. As to this point, nothing is so plain, so clear, or more compendious than the doctrine laid down by Wheaton in chapters 20, 21, and 22, volume the second of his work, where he teaches,—

The sovereign states bound by a federal compact form by their union or a system of confederate states properly called so, or a supreme federal government which is called a composite state.

Under the first system that can be considered as analogous to a treaty of alliance equal between two sovereign powers, each state is bound to the observance of those measures adopted in common and in accordance with the federal compact, maintaining, however, their sovereignty with the restrictions that have been agreed upon. The decisions of general interest agreed upon by the federal body are not enforced as laws, nor are they executed in each separate state, but by the action of the local government of the same, that adopts and decrees them in virtue of their own authority. The consequence of this is that each confederate or particular state and the federal body, in that appertaining to affairs of common interests, can be assimilated within the sphere of their attributions to the distinct diplomatic intercourse with other nations.

In the second case, the federal government created by the union's compact is sovereign and supreme in the sphere of its attributions, and this government not only acts on the state members of the confederation, but also directly on the citizens. The separate sovereignty of each state is essentially altered by the power that is attributed to the federal authority, and by the restrictions that are imposed on the sovereignty of each member of the league. The composite state that is the result of this league is otherwise a single sovereign power.

The 40th article of our political Constitution, dated February the 5th, 1857, says:

It is the will of the Mexican people to constitute themselves in a federal representative democracy, formed by free and sovereign states, in all that concerns their interior regimen, but united in a Federation established in accordance with the principles of this fundamental law.

It is, then, unquestionable that the Mexican Republic is organized within the federal regimen to which this thesis alludes, but as in this country, as in all others in the world, in the first half of the present century, hygiene had not reached the degree of advancement and precision that is to be observed in our days, it would be useless to search among our laws for texts referring especially to faculties granted either to the federal or local powers on subjects relating to hygiene of sanitary measures; it is not till 1870 that we can find in fundamental laws, such as the constitution of nations, any precepts concerning sanitary questions.

Does this mean that the federal or local powers have no attributions on sanitary measures?

Certainly not so; for if it is true that within the last few years it has not had the character of a science (more so since the interesting studies on bacteriology), hygiene can be called to a certain extent a deductive science (as it has embraced within determined principles the main part of its scope of observation, and consequently we do not need to make an experiment for each particular case) from the remotest time and in an empiric manner hygienic questions were not unknown.

It is not contemplated in this essay to enter into learned disquisitions as to sanitary measures tending by means of isolation to prevent contagion in certain diseases, but all those who are engaged in the study of this science, and even those who are but slightly acquainted with it, must know that in the Middle Ages they adopted certain dispositions relating to the pest and analogous maladies.

But that if in former constitutional laws, I repeat, we cannot find any conclusive disposition regarding this subject, it is enough that in general juridical terms even the attributions and conditions of the federal and local powers are defined, for instance: as a direct and necessary consequence of obligations, we can logically agree on the power entrusted to them for the fulfilment of the social duty of adopting measures not only for the improvement of the present races but also of the future ones.

Reasoning thus, and especially as regards the Republic of Mexico, there can be no doubt that the first question proposed in this thesis has to be resolved in an affirmative sense.

What are in truth the characteristics of the federal regimen? That in all that affects any question with foreign countries the component entities of the Federation disappear, and that it, or, in other terms, the Union, is the one that represents the international sovereignty; and it cannot be disputed that international sovereignty has not much to do with sanitary questions, as in many cases there arise questions that are bound with the essentially mercantile intercourse with sovereign countries, the ones with the others; it is an unavoidable consequence that the Union can and must intervene in sanitary affairs.

The main foundation of this consequence is pointing to the second question of this thesis, that the first necessary case of intervention by the Union in this kind of affairs is always when it refers to the relations of one country with foreign ones. But undoubtedly this is not the only

case when the Union must intervene; her intervention also must extend to all those cases that relate to the intercourse of one state or federal entities with the other states of the Union.

Undoubtedly our interior legislation has embraced with all the precision to be wished for the powers that federations have in this affair. On the 18th of December, 1890, congress authorized the executive to publish a Sanitary Code, providing that it should be binding in the district and federal territories as to the matters referring to said localities, and in all the Republic upon those relating to sanitary questions that affect maritime and frontier ports, as to the intercourse of the Federation with foreign countries, or with the states, or among them, and, finally, on all those subjects that bear on general interests. In my opinion, this decree is the clearest and precisest answer that can be given to the second point of the thesis; and the Sanitary Code of the 15th of July, 1891, strictly bound to the decree of the 18th of November, the compendium of which is perfectly formulated in the two expositive communications of the secretary of the interior attached to the code, and in which are the following statements:

In the first volume, federal sanitation is referred to, establishing the prescriptions relating to ports and frontiers, and transmissable contagious diseases from abroad into the Republic, or from one state of our Federation to another, and to other subjects of general interest, as vaccination and medical statistics throughout the country.

The federal sanitary administration is exercised by the functionaries and agents referred to in the 3d article, the provisions of which established an administrative system with a graduated hierarchy clearly defined, which begins with the lowest officials of the several commissions of the corporation, and ends with the secretary of the interior, the superior Sanitary Council acting in all cases as a consultative and technical board with executive faculties.

The text of the second article of the Sanitary Code cannot be clearer. It says:

Therefore the sanitary administration is divided by the functionaries who form it into federal and local administration.

Concrete cases that have taken place connected with the fears recently entertained of an invasion of the cholera at the ports of Campeche and Veracruz, has afforded to the council an opportunity to study attentively the concurrence of powers between federal and local authorities in the above-mentioned ports; and considering that the political constitution in article 72, sections 9, 16, and 22, and in articles 4 and 97, delegates those attributes to the Union, and consequently it can exercise them without excluding local authorities from exercising them. The remembrance that in our times the liberty of nations is not based on the emancipation of the municipalities, and the fact that the general custom-house tariff of the Republic opens Mexican ports to the trade of all nations, and the special disposition of the war department invariably has been to enforce that the police at ports and maritime zones should be under the control of the port captains, who are federal authorities.

These facts made the sanitary council decide that in all cases of conflict on these matters the federal authorities shall always have the preponderance over the state authorities; more so when the last mentioned could not legislate (and they could not do it without diminishing the essence of the federal regimen and without introducing a variety of positive, intolerable dispositions) in affairs connected with the intercourse of the Republic as to other nations. The Superior Sanitary Council, therefore, following the well known doctrines laid down by Kent as to concurrent jurisdiction, has inferred that all dispositions dictated on this subject by the states of the Federation are repealed from the date that the Union issues a disposition about the same matter.

Reasoning: The cases referred to in the second question of the thesis are those embraced in the first book of the Mexican Sanitary Code. The Union must intervene in maritime sanitation, in frontier sanitation, or in the intercourse of the Union with the states, or of those in their intercourse the ones with the others, as, for instance, in cases of vaccination, of medical statistics throughout the country. The Union, in conformity with the dispositions of the sanitary code, must also place its technical corps at the disposal of the federal entities whenever they voluntarily wish to be counselled by said corps.

The thesis also asks, How far can the federal intervention reach?

The answer is very simple. The Union authorities respecting the local ones must be limited by the matters strictly within its faculties, as have been already detailed; as soon as those matters have no longer the character of an international or general interest, the municipality, or, in more general terms, the locality, assumes the supervision of all sanitary measures.

If so far I have only mentioned the resolutions adopted by Mexico, it has been, in the first place, because they are in harmony with the teachings of so learned an author as Wheaton is, and, in the second place, because they agree in their juridical applications with positive precepts of recent constitutions.

On the European continent there are no federations organized as those in America, and, notwithstanding this fact, the German federation, constituted on the 16th of April, 1871, declares in section 1, that the affairs common to the empire are legislation on custom-houses, on commerce, taxes, navigation of waters common to several states, and all police regulations referring to medicine and veterinary. The constitution of the Swiss federation, which is a much more recent one (29th of May, 1874), declares that it is the duty of the confederacy to issue legislative dispositions referring to labor of children in factories, length of working hours for grown-up persons, protection of workmen's lives against insalubrious and dangerous industries, and on all sanitary police affairs connected with epidemics and epizootia that threaten any general danger.

Truly a more interesting example could not be given of positive dispositions in conformity with the logical deductions that have been reached in the former pages of this study. The American constitution,

of a date much anterior to ours, has no particular specifications on sanitary affairs; but sections 3, 7, and 17 of its 18th chapter evidently were the source of the section that I have already quoted of the 72d article of our political constitution, and undoubtedly authorize the neighboring nation to issue regulations, emanating from congress, analagous to our sanitary code, as also to carry on international sanitary agreements with foreign countries, the benefit of which is manifest, as it does away with the many difficulties that are of every-day occurrence in regard to quarantines imposed by the states of the American Union on citizens of other countries without the federal government having previously agreed to them, and even without its knowledge.

The legality of these sanitary measures decreed by the states of the American Union is unquestionable, while the before mentioned federal laws or international conventions are not promulgated; but that fact in no manner weakens the advantages to which I have just referred as to the agreement of those international conventions and to the promulgation of those laws.

It is to be hoped that the meeting of this sanitary Association, in this year and in this Republic, may cause our neighbor to heed the enlightened opinion of the members of the congress who have come to honor our country, and to fix her attention on the study of this matter, and to deduce her conclusions with the equity that she always has given proof of.

XIX.

TO WHAT AN EXTENT IS THE MEXICAN TYPHUS A COMMUNICABLE DISEASE?

By Dr. JESUS CHICO,

Guanajuato, Mexico.

Among the principal pyrexias which demand the attention of the practitioner in the Mexican Highlands, the first place is undoubtedly to be given to an ailment of the family of the typhus diseases, thought by some of our best medical authorities to be wholly different from typhoid fever and from the Irish typhus, although it has with the latter the most striking likeness. Perhaps a brief sketch of its principal clinical features will be of some use to those of our distinguished guests who are not yet acquainted with it.

The beginning of the disease is generally rapid,—some hours of discomfort; a chill, seldom a shivering; a continued fever; violent headache; often at the second or third day bleeding from the nostrils, mostly moderate; at the fourth or fifth are noticed some red spots, like those of measles, on the upper part of the belly, the lower part of the chest, and the back. These spots spread throughout the body, with the exception of the face, where they are seldom seen. They fade gradually away, becoming petechial in some, not infrequent, cases.

Meanwhile, the temperature increases rapidly, reaching its climax in the second day, generally 40° C., or thereabouts, and decreasing in favorable cases from the thirteenth day to the sixteenth, but mostly ending at the fourteenth in crisis or in lysis.

Although there are epidemics in which we notice frequent diarrhœa, generally speaking there is, rather, constipation, often tenacious.

The rapid loss of corporeal vigor and the numbness of mental powers justify more than amply the name applied to this disease, inasmuch as *typhus* is synonymous with *torpor*.

If things are to take a fatal course, we observe frequently signs of meningo-encephalic inflammations, bulbar irritation and paralysis, cervical meningitis. The post-mortem examinations confirm the symptoms noticed intra-vitam as the result of inflammatory processes in the brain, bulb, and upper part of the spinal cord. Such cases constitute the ataxic, malignant form of the disease.

The adynamic variety consists chiefly of the cases of adipose degeneracy of the heart, in which, when the fever is over, the patient ends in a state of hypothermic collapse, with protracted agony.

I think that this short description indicates sufficiently a strong resemblance to the Irish, or exanthematical, typhus. So striking is the likeness, that if we read, for instance, the chapter on typhus written by Thoinot in the second volume of the comprehensive work now edited in Paris under the direction of Charcot and Bouchard, we could easily believe it was a description of our typhus and of nothing else.

So, if I have spoken of the ailment in question as a distinct disease, it is on grounds which I fear will not appear scientific enough. Nevertheless I feel myself bound to explain, and in a certain way to sustain, them.

First, though I may be unfortunate in holding to the discredited principle of authority, the magister dixit, I will bring forward the opinion of Dr. Miguel F. Jiménez, our old clinical teacher. Those who knew him and learned to appreciate the acuteness of his observation, the soundness of his judgment, and the vastness of his medical learning, will no doubt easily forgive me if I bring forth, if not as an argument at least as a strong suspicion of the non-identity of the Irish and the Mexican typhus, the fact that so able a man who saw in Europe so many patients of the first should endeavor to establish the second as a distinct ailment, calling it tabardillo, from a disease of that name which ravaged our country under different appellations, that being one of them, and was believed by him to be the same as the kind of typhus we generally observe.

Nevertheless, as I have already stated, so strong is the likeness we notice between the descriptions of the Irish typhus and the clinical image we observe in the patients of our typhus, that I should not have hesitated long to believe that our dear teacher had committed one of those errors from which no man, however able, is free, when he spoke of the tabardillo as an independent entity, were it not for a circumstance which constitutes the main body of my lecture and of which I am going to speak.

The first which is to be noticed, when reading the paragraphs on etiology in a description of the Irish typhus, is the high contagiousness universally attributed to that disease. We read, for instance, in Niemeyer that if a patient of typhus was brought into one of his wards, the occupants of the neighboring beds caught the disease, which spread from bed to bed till a proper isolation put an end to its diffusion. Fauvel gives, for a single month, the terrible number of 1,235 internal cases in the hospitals of Constantinople, the whole number of patients being 2,848.

These figures are eloquent enough, and prove satisfactorily the contagiousness of the Irish typhus, but with the greatest certainty such is not the case with the typhus observed in the Mexican highlands.

The first circumstance that struck my mind during the period of my medical studies was the difference between the above expressed facts which I read in the treatises on Irish typhus and what I witnessed every

day in the hospital in which I received my clinical instruction from 1872 to 1876 (Hospital de San Andrés). There, without discrimination, the patients of typhus were mingled with patients of every description, and nobody blamed that practice, because it never had given rise to internal epidemics. So striking was this fact that one of the professors of our medical school, Dr. Ignacio Torres, distinguished for the soundness and originality of his ideas, not less than for the want of power of expression, used to argue against the belief of the contagiousness of our typhus, saying, "Our typhus is not contagious, not even with a cloak," alluding to his eternal wearing of a cloak, and meaning that if the germs of the disease could be gathered from the vicinity of the patients suffering from it, he could not have failed to catch them in the folds of his respectable and large covering.

Notwithstanding that everything I witnessed was leading me to the belief that in their respective contagiousness lay the principal difference between the Mexican and the Irish typhus, I contrived to stifle my own judgment and strove to make myself believe that if the inmates of the hospitals did not catch the typhus from their neighbors who had brought it to the wards, it was because the repeated epidemics had conferred upon the inhabitants of the city of Mexico what the Germans would call a *Durchsenchungsinmunitat*—expressive word, whose exact translation I confess myself unable to render.

In 1876, I arrived in Guanajuato, my native town, where I have since stayed, and witnessed as a practitioner the first epidemic of typhus, but, to tell the truth, the difficulties attending the beginning of professional work prevented me from devoting sufficient attention and thought to this matter, and it was not till 1884, in the second epidemic, when, feeling more at home, the old idea which slumbered in my mind began to take strength, and, reflecting that I had in Guanajuato a field particularly favorable for observation and study of this question, I purposed to contribute in the measure of my powers to the solution of the same, endeavoring to find out to what an extent the Mexican typhus could be called a communicable disease.

As I have just stated Guanajuato is in uncommonly favorable conditions for a study of the present subject. The typhus, far from being endemic, disappears during protracted intervals, amounting to more than two years between two epidemics. In this interval there is no lack of sporadic cases, and these give some of the best phenomena for observation. Moreover there is among the inhabitants a close relationship, arising out of the quiet life of this town, which enables the observers to trace out the origin and results of the greater part of the cases.

Once I had made up my mind to pursue this study, it only remained to choose the best method to obtain a solution as accurate as possible. With this purpose I began to preserve a written report of all the cases in which I could obtain reliable information, in order to have at hand a stock of ample material. So, since May, 1884, till October of this very

year, I have collected data respecting 432 patients, not only of those who called me to be their medical attendant, but also of every patient from whose family or physician it was possible to gather information.

In order to present the data in the best possible way to show the result of my inquiry, I put them in the shape of a kind of tabular statement, which I have the honor to submit to your attention.

I.

1. Total number of cases	432
2. Of these there had been previous communication with another case of typhus in	38
3. Percentage of patients who had had such a previous communication (round number)	9
4. Percentage of patients who had had no previous communication	91

II.

1. Patients with previous communication,	38
2. Among these the disease began from one to four days after the communication in	11
3. From four to eight days in	8
4. From eight to twelve in	8
5. From twelve to sixteen in	3
6. From sixteen to twenty in	2
7. From twenty to twenty-four in	1
8. From twenty-four to twenty-eight in	5

In 185 cases, out of the 432 whose data I could gather, it was possible to obtain information about the condition of their attendants, respecting the communication of the disease. Constant questioning about the state of health of these attendants, lasting three months at least after the termination of the attended case, enable me to judge this question from an inverse point of view; and, although in the rest of the cases I could not obtain information because they were people with whom I had no frequent intercourse, I think that the above number (185) representing 43 per cent. of the whole sum, permits us to draw conclusions through analogy. Well then, persons who attended those patients behaved themselves with a self-denial whose heroism nearly amounted to sheer imprudence. Without any precaution at all, or with mere nominal care, they handled the patients, their linen and furniture, and their dejections. They spent many long hours with the patient's head leaning on their bosoms, caressing them as usual, and, let it be said in praise of the educated class of Guanajuato, among whose members I beheld the largest portion of these instances, when they so acted it was under the belief of the possibility of the contagion. I shall present the result of this part of my inquiry in the following shape:

III.

1. Average of kinsmen, friends, and servants who attended the 185 patients recorded (number very near to exactness)	8
2. Total number for the 185 patients . . .	1,480
3. Persons who, out of these, caught the typhus during or after their nursing	21
4. Percentage of attendants attacked . . .	1.041
5. Percentage of non-attacked attendants . .	98.959

Let us now consider this question under another aspect: There is a remarkable relationship between dwellings and typhus. I do not mean the abodes of our poor, low people, where agglomeration, dirt, and bad food produce an inextricable entanglement of causes, and it is impossible to discern or discuss anything clearly: I mean the houses of people who can be called at least well-to-do people, to those dwellings where the room formerly occupied by a patient and the chambers near to it are thoroughly cleansed, and are either papered anew, or have their walls scratched and whitewashed. Perfectly well known in Guanajuato are such houses, where we find frequent cases of typhus. Out of them I will speak, first of all, of the house which is next to the residence of the administrator of the general hospital, where, in the last decade, we have noticed at least fifteen cases; the house which is at the corner of Estrella lane and Palace row, with six cases in the same period; to the house at the foot of the Plazuela de los Carcamanes, now fortunately a heap of rubbish, where every family who dwelt in it had among its members a case of typhus. Paying attention to that circumstance, I inquired from each patient if he knew whether his dwelling had been visited before by typhus. As was to be expected, poor people who often change from town or at least from suburb, thus losing of sight their acquaintances, and who only think of earning a hard livelihood, could not answer any questions in the majority of cases. It was not so with well-to-do people with whom my inquiry was particularly fruitful, and I found out that of the total number (432) sixty-four patients dwelt in houses where formerly there had been some patients suffering from typhus. No doubt, that if I could have gathered more information, this number would have been larger. Such as it is I present it in my last numerical table.

IV.

1. Total number of cases	432
2. Out of these, there dwelt in houses formerly haunted by typhus	64
3. Percentage	15

Let me now discuss with the required conciseness the considerations that arise out of the presented data. In doing so I shall examine the

same objections which I first proposed to myself when I began to reflect upon this subject. Perhaps some of them will be of those on which some of you would oppose me, in case you deign to pay attention to my lecture.

I.

The majority of the patients, when being questioned about their having had a previous communication with some other patient, answer negatively. Almost always they impute their ailment to a sudden cooling: they claim to have been wet through by the rain, or by water thrown out accidentally from some house; sometimes they have gone out without precaution from a warm apartment to the cold air, or they have stayed long in a draught. Many know not to what to ascribe the cause of the illness, and, as the first tabular statement shows, 91 per cent. have been taken sick without having seen another patient. Well then, do we not deal here with a great number of cases of indirect contagion? This contagion could have been carried by an intermediate person who might have attended a patient, and with whom the new patient might come into contact unawares? I would say to that, as I said to myself some time ago, that, first of all, the families and acquaintances of the physicians should be among the most numerous victims if this way of contagion could exist. Does this really happen? I address myself to physicians, and I am sure that everybody will answer that they have had the misfortune of carrying home scarlet-fever, measles, small-pox and other minor ailments, but not typhus, thank God! The rest are more than sufficient ofttimes to make the physician repent of his calling. In the second place it would be the most singular thing if the immediate attendants were spared by the sickness as a rule, and that those who have only an indirect contact with the patients were its preferent victims.

The physician is rarely attacked. In Guanajuato during a period of twenty years, only two have caught it, and that in the midst of an epidemic; while in Prague, during a single epidemic of Irish typhus, twenty physicians contracted it, and in the Crimean War, among four hundred, fifty-eight died, the number indicating a large number of patients.

II.

Thirty-eight is the number of cases recorded in which the patients had previous contact with typhus. Apart from its etymological meaning, is contact contagion? Allow me to discuss this subject as rapidly as possible. In the first place, let us consider the twenty-seven cases in which the ailment began in the twelve days which followed the communication with another patient. Out of those cases twenty-one have been attacked in houses haunted by typhus; every one of them lived with the former patient, partaking of the same air, the same water, and identical food. I think these cases are, rather, serial infections, sometimes even simultaneous. Let us take, for instance, the little epidemic circumscribed to the "Vecindad de las Animas" (Vecindad is a kind of

building for several families, each having apartments of one or more rooms called viviendas). On September 14, in the first apartment, a woman begins to be indisposed; she is a member of a different family. At the first chill she goes to her own home walking by herself; in the same apartment two men get sick on the 15th, and a child on the 16th. In the meantime, in the other viviendas, and without mutual intercourse, four persons are attacked.

Do these cases indicate contagion or, rather, simultaneous infections? If contagion, what becomes of the incubation believed to require nearly twelve days? I think there is no exaggeration in asserting that those attacked before twelve days have elapsed after the communication are the victims of an infection developed more slowly than that of the first case, rather than the victims of contagion; and I think that the fact that the majority of these cases have fallen in houses frequently visited by typhus, stands rather for infection than for contagion.

There is a balance of eleven cases in which this sickness began more than twelve days after the communication. Are they to be considered cases of undeniable contagion? I do not wish to appear extreme in my ideas, nor neglectful of the arguments of probability; but I cannot defend myself from the thought that these cases are of infected persons who came accidentally into contact with another person previously infected. When I reflect that the majority of the patients from whom I have gathered information have acquired the ailment without any previous communication, I can but think that those who fell after such communication would have fallen anyhow without it.

III.

I shall say only a few words about the statement relating to the attendants of the 185 patients recorded in it. First, I am quite sure that when I reckon the average number of attendants to be eight, rather than overrating, I underestimate that number. Everybody who knows the warm heart which is characteristic of the educated class of the people of Guanajuato, and their readiness to offer assistance to the families who have a patient of typhus among its members, will give me full credit; second, it could be believed that there is contradiction in the data I present, because in the second tabular statement I speak of 38 attacked with previous communication, while in the third I reckon with 21 attacked attendants. This difference was originated only by the way in which I collected my data.

IV.

Sixty-four are the patients who, according to my inquiry, got the typhus in dwellings haunted by this disease. Out of them the majority are sporadic cases, which suggest to my mind some reflections, stated briefly as follows: When we notice one case of small-pox, scarlet-fever, or measles, we notice many more cases immediately afterwards; the first

case we observed was but the beginning of an epidemic. In Guanajuato, at least, we never see sporadic cases of the above named diseases, all the cases observed being epidemical. In this we know principally the eminently contagious character of those ailments. Well then, if our typhus had any etiological similarity with them, could we observe sporadic cases? The existence of such cases is, for me, one of the more important reasons for believing that in the etiology of Mexican typhus, infection predominates over contagion. If the latter were predominant, every sporadic case would give rise to an epidemic, unless special precautions were taken against its diffusion, and such precautions are never taken.

Distinguished guests and dear countrymen, let me finish. Perhaps, in contending against an exaggerated idea of the contagiousness of the Mexican typhus, I have acted as the well known drunkard who, while riding, inclined to the right, and when told to take an erect posture, inclined to the left. If so, I do not doubt that your illustration will correct my ideas. In such a hope, I end here with this proposition:

The Mexican typhus is rather infectious than contagious.

COROLLARY.

The endeavors of the authorities and private persons must be directed to the improvement of the sanitary conditions of dwellings and towns, rather than spent on the isolation of patients.

XX.

PROPHYLAXIS OF HYDROPHOBIA IN MEXICO.

By Dr. AUGUSTIN REYES,

Member of the Superior Board of Health.

Mexico.

The distinguished French savant, M. Pasteur, in an article which he read before the Academy of Science, of Paris, in the session of February 25, 1884, after mentioning the various experiments which he had instituted in order to discover the attenuation of the virus, producing experimentally divers grades of activity of the same virus and thus obtaining the prophylaxis of several illnesses, remarked respecting hydrophobia as follows: "Cannot human skill avail itself of the long period of incubation of hydrophobia, so as to reach the refractory state of the persons bitten in the space of time which occurs before the symptoms of hydrophobia show themselves?"

A short time passed, and the prediction of the illustrious savant was confirmed. In fact, in July, 1885, a boy named Josef Meister, aged 9 years, was presented to him showing many bites received from a mad dog. Guided by the confidence he had in his experiments, sure that he had found that which he had so eagerly sought for, taking as a principle the positive results which he had obtained in his repeated experiments on several animals, he did not hesitate to apply to this child, a certain victim of this horrible complaint, a treatment that would preserve him from the cruel sufferings of hydrophobia. With a firm hand and with the faith which that judicious induction belonging to men who consecrate their lives to the search of the secrets of science inspires, he practised on the child Meister the first prophylactic inoculation for hydrophobia on the 6th of October, 1885, in the presence of Professors Grancher and Vulpian, and he continued inoculating for ten days or more up to the 16th of the same month, having the great satisfaction of seeing his conjectures realized and of stating the basis of the prophylaxis of hydrophobia—an extraordinary conquest for which the whole world owes him imperishable gratitude.

Our country, desirous of the advance of science and a constant admirer of great deeds, followed with enthusiasm the advances which the French genius made in his studies on such a difficult subject, and with real interest watched the steps taken by M. Pasteur, until it applauded frantically the positive result obtained the inoculation of the child Meister.

M. Pasteur's technics for the preventive treatment for hydrophobia being known, many nations hastened to institute establishments in which the preventive inoculations should be practised. Mexico followed them, and taking advantage of the visit, which in July, 1887, he made to Europe, the distinguished and wise physician, Dr. Eduardo Licéaga successfully brought, on his return in January of the following year, the active virus of hydrophobia in the brain of a rabbit preserved in sterile glycerine, which he received from the Pasteur institute on the 19th day of that month.

With small portions of this brain the first inoculation was made on a rabbit of Belgian breed in the Superior Board of Health on February 17, 1888, the second on the 18th, and the third on the 20th. Thus the first inoculation was made here with the brain of a rabbit 29 days after it had died of hydrophobia in Paris.

The result of these first inoculations was satisfactory, as hydrophobia was produced in two of the rabbits, the ones that were inoculated on the 18th and 20th; the first died on the 1st, and the second on the 5th, of March.

From these dead rabbits the medulla was extracted to preserve it and portions of the bulb were taken to make fresh inoculations on rabbits, rigorously following the technics of M. Pasteur, to constitute the first culture of the virus in Mexico. We have arrived to-day (October 23, 1892) to the 164th proceeding and 1,324 rabbits have been inoculated.

On April 23, 1888, and before we had completed the series of medullas, because we had not been able to manage so that one rabbit would die regularly every day of hydrophobia, a boy was presented to our laboratory of bacteriology, named Isidro Delgadillo, twelve years old, who had been bitten on the 20th by a dog which was reasonably suspected of having hydrophobia, from the particulars given by the patient's father.

At the request of the latter it was decided to begin the preventive treatment, taking advantage of a means to complete the series of medullas of all ages which Dr. Nicholas R. de Arellano, member of the Superior Board of Health and of the bacteriology commission, had planned. Said proceeding consists of placing in sterilized glycerine contained in a a flask with an emery stopper, also sterilized, the medulla of the age which it is necessary to preserve, the one which by experience we have been able to confirm gives the desired result.

The first injection was made that same day with portions of medulla of twelve days, and the treatment was continued up to the 16th of May, having made three successive series of inoculations, the first with medullas of 12, 10, 8, 7, 6, and 5 days, the second with medullas of 10, 9, 8, 7, 6, 5, 4, 3, and 2 days, and the third with medullas of 8, 7, 6, 5, 4, days.

We are sure of having prevented the illness of the child Delgadillo because up to to-day he has not had the slightest symptom of the disease.

The first treatment, which I have briefly related, being made, we have

gone on making, in the special department of the Superior Board of Health designed for such a philanthropic end and founded by the present secretary of government, the preventive inoculations for hydrophobia on as many persons as have presented themselves to ask for them; the greater part of them have been bitten by dogs, some by cats, one by a wolf, and another by a coyote. In some cases it has been possible to prove experimentally that the animals which caused the wounds had hydrophobia, in others it has not been possible because the persons bitten have come long distances, or because the animal has been killed several days before the bitten ones presented themselves to the Anti-Hydrophobia Institute.

The general method which we follow in Mexico for prophylactic treatment of hydrophobia, is the following: we make the first with three series of inoculations, with medulla of 10, 9, 8, 7, 6, 5, 4, 3, and 2 days; the second with medullas of 9, 8, 7, 6, 5, 4, 3, and 2 days, and the third with medullas of 8, 7, 6, 5, 4, 3, and 2 days, repeating in this last series those of 4 and 3 days; the injections are made twice a day, one at 9 a. m., and the other at 6 p. m., and the treatment lasts fourteen days.

In the cases in which the wounds are severe, and on the head, on the face, or any uncovered part, when more than twenty days have passed since the bite, there being knowledge, or a well founded suspicion, that the animal which caused the wound had hydrophobia, or else when the symptoms of hydrophobia are perceptible on the patient, the treatment is modified reducing it to seven days and a half, applying the injections four times a day and making use of the fresh and most virulent medullas, that is to say, those which are extracted from the vertebral canal of a rabbit immediately after death.

As in the Mexican Institute only one rabbit is inoculated each day, it sometimes happens that it is not possible to have a medulla of a given age, because not all these rabbits die in the same period of time; this inconvenience we have overcome by preserving in glycerine a part of the medulla, at the same time preserving from the air in sterilized flasks a culture planned by my esteemed companion, Dr. Nicolas R. de Arellano, as I showed before, valuated in a period of four months.

By this means, it is always possible to complete the treatment of persons who attend the Institute, without ever missing the injection which corresponds to each one, with a medulla of the respective age.

As will be seen from the above, the technics of the anti-hydrophobia inoculation have had three slight modifications, without in any way altering the results, viz:

Preservation of the medullas of rabbits, which have died of hydrophobia, in sterilized glycerine, by which means it is always possible to have a complete series for the practice of preventive inoculations.

Reduction of the number of days of treatment, because practice has shown us that, at least in Mexico, the application of medullas of more than ten days is absolutely ineffectual.

Uniformity of treatment to all patients before twenty days have passed

since the wounds were made, when these are on the head or on the face, and when symptoms are shown of hydrophobia or precursors of the illness.

From the 23d of April, 1888, up to this date we have inoculated 659 persons, and among them we have had only three unfortunate cases. I will briefly describe each of these three:

Agustin Sandoval, the 13th of August, 1889, received two bites in the left leg, which was bare. The skin and the cellular tissue suffered. The same day he presented himself at the Anti-Hydrophobia Institute, where the first injection was made with a medulla of twelve days, and medullas of less age followed during the other days; the second and third series were commenced with a virus of ten days. In the course of the treatment he failed to receive five injections, that is to say, there were reasons for his not being inoculated that number of times. Thirty-seven days after having been bitten, the 19th of September, symptoms of hydrophobia appeared in this patient, and he died on the 26th.

To make sure that the dog which had bitten this patient really had hydrophobia, two rabbits were inoculated with portions of the bulb of the dog; one of them died of encephalitis and the other of paralytic hydrophobia seventeen days after being inoculated.

Francisco Bezares, a girl of six years of age, native of Atzcapotzalco (Federal District), in the beginning of October of 1891 was bitten by a dog which had also bitten four other children, one of whom died of hydrophobia on the 2d of November; we could not find out what symptoms the animal showed, as the child's family could tell us nothing in that respect. The afternoon of the 11th of November she was brought to us at the Institute, and from that day to the 15th, the two first series of inoculations were made, and on the 16th and 17th six injections with medullas of one day were applied to her.

When we saw this child she had fever and cried in a peculiar manner, but she did not show the characteristic symptoms of hydrophobia. After two days she began to be uneasy, was very easily frightened, and she still had fever; the 16th, pharyngeal spasms were noted, dyspnœa, trembling and prostration; her pulse was weak and fast, 120 beats per minute; the following day the case was more serious; in the afternoon agony began, and she died shortly after.

Antonio Ramirez was bitten on the 8th of April at 9 a. m.; he had several wounds a few millimetres in size in the right malar part and in the upper lip; on the same side the cellular tissue and the annexed tissues suffered. Three series of inoculations were made; the first was begun with medullas of ten days, the second with medullas of nine days, and the third with medullas of eight days.

On Sunday the 7th of May, he began to feel pain in the lip and in the right cheek, numbness in the same parts, cephalalgia, uneasiness. The 13th, he was brought to the laboratory; he had all the symptoms of hydrophobia and fever; temperature 38° 5 C., 136 pulsations per minute. That day and the following, injections of medullas of one day were made. On

the 15th, the temperature was 39° C. and he showed a strongly defined typhoid condition on the skin of the abdomen towards the hypogastrium; on the lower face of the forearm he had spots characteristic of typhus. He showed also spasm of the pharynx. convulsions, violent delirium, ptyalism and the characteristic aspect of those suffering from hydrophobia. He died on the 16th, at night.

These three unfortunate cases that we have had since the Mexican Institute of Anti-Hydrophobia has been established, during which time 659 persons have received the preventive treatment, represent a mortality of .045 per cent, a relatively small percentage against the benefits that have been conferred, saving more than 600 persons from certain death.

XXI.

THE FUNDAMENTAL CONDITIONS OF PUBLIC HEALTH IN CIVILIZATION.

By GEO. HOMAN, M. D.,

Professor of Hygiene and Forensic Medicine in the Medical Department of Washington University, St. Louis; Member State Board of Health of Missouri.

Preliminary to the consideration proper of the subject indicated by the above title, I deem it well to say that I shall deal with man simply as a product of evolution—assuming, as he stands now in his highest estate, that he represents the fruitage of the operation of developmental forces through uncounted ages; my view of the story of Genesis being that it merely refers to that point in time and evolutionary change when there was developed in the man-like animal that which conclusively differentiated him from the brute—by whatsoever name or criterion it may be known or adjudged—as reason, conscience, moral nature, or, as scripture has it, "and man became a living soul."

As the race emerged from the anthropoid state into the conditions of primitive man and he appears dimly distinguishable through the mists that obscure the dawn of history, co-eval with his coming were the beginnings of rational or intelligent hygiene as contrasted with natural or instinctive hygiene, whose many marked manifestations are observable among the lower animals to-day.

It may well be supposed that the unique beings who represented man in his earliest state, and who perhaps gained a precarious subsistence by fishing and the chase, made no conscious application in their lives of any sanitary rule or measure; but as man progressed in his upward course and passed successively from the low savage to the pastoral condition, and then to the agricultural stage, and from that again to the manufacturing state, and finally developed into the commercial stage, reaching the status of civilized and enlightened man, the evolution of hygiene went on, and its more or less perfect application to the concerns of every-day life and living became a necessity in proportion as the members of the race came together in fixed habitations in the family, the community, and the city.

As nearly as it is now possible to approximate the facts in this regard, it was not until mankind became aggregated into large communities in the course of development on a considerable scale of manufactures and

commerce, or when the military necessity for walled cities arose, that conditions were brought about, out of which were begotten communicable diseases, pandemic in purpose, dominion, and power, and which, in their extended sweep, have whitened the earth with the bones of unnumbered multitudes of victims.

Asiatic cholera well illustrates a type of persisting pestilence, originating in the far distant past, in sub-tropical regions, with the concomitants of dense population, climatic moisture, and filth, the presence and peculiarity of the latter being in definite relation to certain social customs and religious beliefs of the inhabitants; and the native vigor of the specific organism on which this form of disease depends is such that it has not only more than once passed around the earth in the equatorial belt, but has invaded the temperate zones to their farthest edge, and, through its ravages, has left behind a name that is at once a dread memory and a menace to mankind.

It has been the wont of uninformed men to regard these morbid or epidemic occurrences as being due to supernatural power, divine or diabolical, as the fear, fervor, fancy, or fanaticism of persons or people affected might dictate; but modern science, working along the line of microscopic research, has furnished the explanation of the causes of most of the grave diseases which affect mankind, and it is known that the growth of a crop of cholera or consumption is the result of just as orderly natural processes as the production of a crop of cabbages or corn. It has succeeded in isolating and identifying the principal bacterial parasites, which possess power to destroy health and life; and while by far the larger number of the known varieties of these low forms of life are not only harmless to man, but play an indispensable role in the operations of life-giving nature, it has been shown that under certain conditions some of them lose their benign nature and take on the destructive powers which mark certain forms of disease.

Long-continued observations of human populations have all tended to show that, given certain conditions in a crowded city—the chief of which are darkness, dampness, and dirt,—well defined forms of disease will surely be developed there; and, if these be communicable in their nature, that such localities will constitute centres from which disease will be radiated to the surrounding people as the rays proceed from a lighted candle. In public health language they are known as plague spots, fever nests, hot-beds of infection, centres of contagion, and the like; and, if "far that little candle throws his beams," who can calculate the distance to which disease may be projected from such sources.

The questions at once arise, Why will people consent to live in such localities, when the danger of sickness and death is so great? and, Why will the surrounding people, secondarily exposed to such dangers, consent to or tolerate their continuance? and these questions go to the very core of the whole matter and touch the underlying causes from which spring the monstrous, unnatural effects and conditions which we see in the midst of the so called Christian civilization of to-day.

The true position of man in nature, so far as his physical health is concerned, may be most clearly understood by regarding him simply as a land animal—as the highest type of land animal,—and his wants as such are anticipated and met by the provisions of nature, of land on and from which to live, the air to breathe, sunlight to enable him to see, etc.

By the gasp and cry which signal the entrance of air into its lungs and the arrival of a new-born child in the world, whether it come of prince or pauper, there is established of natural right an indefeasible title to a portion of air equal to that of any other living child, so long as the necessity for air shall continue. If proof of this be needed, let the lungs of two men, one a hereditary noble and the other a day laborer, be submitted to the most profound naturalist, anatomist, chemist, or histologist, and, though ever so skilled, they could not, by their tests, determine and say, "This infallibly came from that certain body." Or let the visual organs of two such persons be placed before the most expert oculist or optician, and they could not by any peculiarity of part or structure distinguish the one from the other. Again, let all the viscera of two such bodies be submitted to every known test by the most accomplished surgeon or physician and they would be equally at fault. They would see similarity in structure and organs and in the relation and arrangement of parts, but no mark placed there by nature to indicate the high degree of one or the low station of the other. Indeed, the appearances revealed by such an inspection would, in many points, suggest a close and unflattering relationship to a very common domestic animal.

No natural difference then between these two land animals being discoverable, their needs, so far as the supplying and satisfaction of their wants are concerned, must be the same; and, coming into the world in the same fashion, their right to the provisions of nature to meet such wants is the same; and precisely as access to such provisions is unhindered and complete will be the health of those individuals. They must have sufficient space on the earth in which to live and move without engendering disease, with their rightful share of pure air, sunlight, and other natural accessories to health.

The Biblical story of human life being prolonged through many centuries may or may not be an exaggeration, but certain it is that the then existent conditions were most favorable to healthful living and hale longevity; but as man proceeded thence in his social, industrial, and civil evolution, coming together in more or less dense aggregations, as the manufacturing or commercial instinct perceived localities of advantage or points of strategic importance, the conditions changed for close association with fellow-craftsmen, and stable residence became a necessity where such industries were pursued.

In man's more primitive stages, land as such had only a grazing or agricultural value, but as population thickened, and handicraft employments arose and grew, and trade and travel developed, so in proportion grew the speculative or site value of land at those places which, for whatever reason determined, had been chosen as the seats of industry,

because of the competition between people at those points for convenient business and residence locations.

Naturally those who could first seize and control the land at such a place possessed a decided advantage, and could fix the terms on which others might come to live or work, and thus reaped gain, without merit or labor on their part, by taxing the necessity, industry, skill, and enterprise of their fellow-men; and, as all know, this is still going on at the present time.

The greater portion of all city inhabitants are now, as always, hand-workers; they constitute the bulk of population, and are, as a rule, dependent on their daily earnings for support. The means of an individual of this class do not permit him to occupy a very large part of the earth's surface, even if he is able to own such a space, which usually is not the case. The item of rent is one of his chief and most immediate concerns, and the premium he is forced to pay to another for the right to land and living presses constantly on his resources. Should he lose his employment and default in the rent, he is liable to eviction; and numerous coöperating causes, as sickness, decreased earning power, an increasing family, etc., all tend to force him to narrow his living space on the earth, and as this shrinks, his share of pure air and sunshine dwindles likewise, for virtually they, too, are owned by the landlord.

Such an example is only one of many that might be sketched of those suffering to-day from like causes, and where such a general state of affairs exists the genesis of plague spots is easy, for infection thrives amid uncleanness and want, darkness and damp, and soon takes on most potent forms and powers.

Bacteriologists have conclusively demonstrated by repeated laboratory tests, that varieties of bacteria, which ordinarily are beneficent to man by turning dangerous organic matter into forms suited to plant life, when placed with such matter in a dark, damp, stagnant atmosphere change their nature and become noxious to human health and life. This fully accords with the experience of physicians and sanitarians, whose observations show the development of the most dangerous diseases amid conditions of human overcrowding, the germs of which so produced may swiftly infect nearly the entire susceptible population.

The acute forms of these diseases visit most heavily infancy, childhood, and youth, but even these elements of population in the immediate disease-area, though sore distressed, do not always suffer as severely as those at a distance, for medical experience has shown that a degree of immunity to these forms of poison can be acquired, somewhat as opium and arsenic eaters and users of tobacco gain tolerance of those poisons.

What are the pains and penalties violated nature exacts and imposes for such trangressions? Let the graveyards speak—even those where the costliest monuments rise—and say how many of those buried there lived to old age, and how many reached that period unvexed by preventible disease. Let the multitudes that overcrowd every hospital, asylum, and dispensary in the land be also taken into account; and, not least of

all, the haunting sense of dread and fear in every household against the hour when infection shall stand within the door and reach with grisly hand for those least able to resist.

Herein perhaps is retributive justice to modern society, for it is worth noting that the spreading plagues of old, those, for example, springing from beleaguered cities or rising in the wake of armies, spent their principal force on grown people, sparing the young somewhat, and this explains the recuperative power shown by populations, which at times, by the accounts of conservative authorities, were more than trebly decimated. But now the swiftest blows are aimed at the young, weakening or destroying population near its sources; nor do grown people escape, all ages being exposed to the power of enfilading infections.

The seeds of disease can enter the human system by three routes, and only three, namely, through the air passages by being breathed in, as consumption and diphtheria; by being swallowed, as cholera and typhoid fever; and by inoculation through the skin or outer mucous surfaces, as hydrophobia and glanders. Some can enter in all three ways, of which the universal plague, tuberculosis, is an example.

The winged or air-borne diseases are most dangerous in civilized countries, and the great problem with sanitarians is to prevent the air becoming loaded with their germs. In a city this is impossible, when their wholesale production in certain localities goes on perpetually, and every person breathing such air becomes morbidly liable to them himself, or to carry them with him in his person or clothing to give to others.

What meant the slight fever, or malaise, or headache, or "cold" of yesterday or last week? Probably that an attack had been made upon our vital powers by the aerial enemies that compass us about, which, however, was soon and easily repulsed. But to-morrow, or next week, or next year, the forces that guard our health and lives may be weakened or caught sleeping, the citadel may be entered and a long spell of sickness follow. If it be of a communicable nature, even though developed far away from the place where it was contracted, a new danger centre to public health is created, unless the most vigilant precaution be taken to prevent the escape and diffusion of the volatile infection.

From a public health stand-point there is no place in the economy of unperverted nature for either a Dives or a Lazarus; in primitive conditions they could not exist, and under natural conditions now they would substantially disappear. The lazarets all over the world show too plainly the disposition to attempt to substitute charity for justice, but modern civilization waits on justice alone to place it upon a foundation other than human bones; for the conditions must again change to enable man to rise to high and higher development.

It would be the language of madness to say that there is not fresh air and sunlight in overflowing abundance for every human being in the world, and it would be equally foolish to say that there is not land enough on which all could live wholesomely and without danger to their neighbors. But of what use are the other gifts of nature if man cannot

get enough living-room on earth to enjoy them? What are the facts in this regard? Under the influence of present laws and social forces, the centripetal pressure is so great that population is becoming massed as never before. In the city of New York in localities where hundreds of thousands of people live, the average space of land per capita is about one square yard, exclusive of street and other common areas, and other cities are fast following in the same path. This continuous dense massing together of human beings equals probably anything that occurred in past ages in time of warfare and siege, when outlying populations were driven for safety within the city walls.

This is the situation which confronts the civilization of to-day. Its consequences are serious enough already, for nations have expired and civilizations have withered and passed away from causes that had their root in conditions of population now existing here; and no certain remedy is possible so long as to some men is given power to seize and hold the keys of the storehouse provided by nature, and to which all men must have access for nourishment, health, and life. Private property in land can ultimately lead to but one end, and that population disease, decay, and death. As these three have all seasons for their own, so should right-doing, restitution, living justice; and these will never be satisfied until every human land-animal, every child of man, is secure in the possession and enjoyment of every provision of nature freely supplied for the welfare of its physical body. All of these in due share are the fundamental conditions of public health—the same to-day as ever, the benefaction of nature, and the birthright of man.

XXII.

THE EXTENSION OF THE USE OF LIVE STEAM TO MUNICIPAL AND HOUSEHOLD DISINFECTION.

By GEO. HOMAN, M. D.,

St. Louis.

The successful application of the Holt system of disinfection to maritime sanitation, based as it is on true scientific principles, is in its results one of the most gratifying evidences of the progress of modern hygiene, and is an achievement in which this Association may well indulge a pardonable pride.

While the complete system, as operated at well equipped seaboard quarantine stations on this continent, embraces the use of chemicals as well as live steam, I desire in what I now have to say to confine my remarks to the latter, and shall therefore presume to remind those now present of the ways in which this potent agent may be made to subserve still more usefully the ends of public health.

The use of super-heated steam for the destruction of harmful bacteria and their spores as these are found on ship-board, and in the clothing, bedding, baggage, and other personal effects and belongings of their crews and passengers, may be regarded as the mainstay of true disinfection by reason of its speed, certainty, real economy, ease of application, etc., and these considerations weigh equally in its favor with those who seek the further extension of its employment as an every-day weapon in city sanitation in the warfare against disease.

During the present year I have made it a part of my duty to endeavor, as diligently as possible, to make known to the medical profession and people of Missouri the arguments in favor of steam disinfection and the benefits that would follow the general adoption of this agent as a part of the equipment available to subdue infection among our people, and I am pleased to be able to say that these suggestions have everywhere been well received, and I am hopeful that much good may come from efforts made in this direction.

Besides laying the matter before several local societies I presented it at the meeting of the State Medical Association in May, which body promptly approved the proposition as embodied in a report of one of its committees by unanimously passing the following resolution:

Resolved, That this Association endorses the recommendation of the Committee on State Medicine to the effect that disinfection by steam heat properly applied is the most efficient practicable agent for the treatment of infected garments, bedding, etc., without injury to their texture, and as such is commended to the notice of municipal health authorities throughout the state.

The State Board of Health similarly favored the proposition by adopting at the July meeting preambles and a resolution as follows:

WHEREAS, The importance of the speedy destruction of the dangerous or infective matters given off from the bodies of persons sick with communicable diseases cannot be too frequently or strongly impressed on the public mind; and

WHEREAS, Practical experience and scientific experiment have alike proved conclusively the high degree of efficiency possessed by super-heated steam, or steam under pressure, properly applied to speedily accomplish such destruction; therefore be it

Resolved, That it is the sense of this Board, in the interest of the public health, that the duty and necessity of providing proper means for steam disinfection should be brought to the attention and impressed on the minds of all municipal and local boards of health in this state as affording in the long run, the cheapest, readiest, and most efficient practical method of securing the destruction of the germs and spores of diseases dangerous to animals and man deposited on or harbored in woollen garments, blankets, domestic furnishings, etc., the pecuniary value of which would forbid their destruction by fire.

In the belief that the practical importance of extending the use of steam disinfection as widely as possible was worthy of the serious consideration of the National Conference of State Boards of Health, I also laid the matter before that body at its meeting this year, and it is now in the hands of a special committee for report at the next meeting.

The board of health of the city of St. Louis has also taken this question under advisement, with a strong probability of the adoption of the system as soon as financial means adequate to the purpose are provided.

Besides the uses of steam for swift and thorough disinfection in the presence of disease, where recourse to such a measure is demanded to arrest its spread and secure public protection (and for which purpose there should be a plant or plants in constant readiness for use), there is a crying demand for such an appliance in connection with every public charitable institution where those received for care or treatment bring with them garments, in the meshes of which may be lodged the bacteria of many diseases, collected from many different sources through many months of time.

For example, it is the custom at the public (city) hospitals in St. Louis when patients are received, to deprive them of all their own clothing after supplying their needs from the hospital stock. Their own body garments and other articles that are washable are then sent to the laundry, and, after purification, returned to their owners when they are ready to leave the institution. But no attempt is made to free from possible infective danger the heavy outer garments brought in by the patients, these being put together in bundles and held for their owners until they are able to go out again.

Of course it is out of the question to subject heavy woollen outer garments, furs, etc., to laundry processes, but it cannot be denied that such articles are a greater source of danger to public health than are the body garments, and they should no more be permitted to leave such an institution without disinfection than the latter.

For this reason, and to meet this plain necessity, a steam disinfecting equipment in connection with every public hospital, poorhouse, prison,

asylum, etc., is indispensable, this use being a proper and obviously necessary extension of its range of application.

It will hardly be disputed that fomites of the kind indicated are responsible for a very large share in the spread of the acute exanthemata, and, probably they play no small rôle in the dissemination of tuberculosis and other forms of slow infection; and professional and sanitary judgment as well as public opinion should, and no doubt will, fully support every feasible measure the effect of which would be to abridge their harmful powers.

Aside from the field for such work constantly presented in connection with eleemosynary institutions another most important branch of the service would be the treatment, without injury to texture, color, etc., of carpets, rugs, bedding, household furnishings, heavy clothing, and the like from private houses invaded by communicable disease, and the benefits of which service should become promptly available without charge on the order of the attending physician, the local health officer, or on request of the affected household.

It is not probable that more than this could with confidence be expected of steam, as its application to the disinfection of rooms, houses, etc., is hardly practicable, and therefore means for this purpose must be sought among appropriate chemical agents. Indeed, in the every-day sanitation of cities and houses, chemical disinfectants and steam are, as in maritime sanitation, indispensable helpmeets, each supplementing the good work of the other when intelligently used.

As regards the details of this extended service, it would appear that no difficulties of any magnitude present themselves to be overcome, except those incident to procuring the needed funds to meet the expenses of such a departure in municipal hygiene. But when the solid merits of such a service were made to appear, and they can be very fully demonstrated to even unlettered minds, the financial difficulty would doubtless wholly vanish.

As respects the mechanical features of such a station, it is altogether probable that, with a few minor changes, the specifications followed in the construction of the latest style of plants for maritime disinfection would entirely suffice; the principles there fully illustrated would apply equally elsewhere, when the work to be done was of the same character.

To those who have given little thought to the matter, or who have been impressed with the magnitude of the works at some of the quarantine stations on our seaboard, it might appear that it would be a hopeless task to institute this form of disinfection in small or poor communities; but the fact is that neither an expensive outfit nor one that is stationary is necessary, for, provided a sufficiently tight and strong chamber in which to expose the articles to be disinfected is secured, the steam generated by portable boilers, such as are in common use to furnish power to threshing machines, saw-mills, etc., is amply sufficient for the purpose, and the cost of operation of such a service would be almost insignificant.

It has occurred to me that possibly objection might be raised to the

carriage through the streets and other public places of articles for disinfection, on the plea that public health would be thereby endangered; but this falls to the ground as a criticism in face of the fact that the carrying to and fro of such articles by laundry wagons, and by washerwomen and old clothes men on street cars and afoot, goes on almost continually in every city, and that this present danger would be greatly lessened, or abated entirely, by the use of city wagons of appropriate construction, properly equipped, and in charge of careful persons.

I trust that what has been set forth herein may commend itself to the sound judgment and progressive thought of this body of eminent sanitarians, and that, under the stimulus which such a movement may receive from your enlightened sanction, the use of live steam as a means of combating infection will find ready acceptance in every city and town by the health authorities as an indispensable auxiliary in their warfare against disease.

XXIII.

THE MEMPHIS SYSTEM OF SEWERAGE AT MEMPHIS AND ELSEWHERE.

By GEO. E. WARING, Jr., M. Inst. C. E.,

Newport, R. I.

The system of sewerage first constructed at Memphis in 1880, was first formulated in a paper read before this Association at its annual meeting of November 18, 1879. But for the dire need of that stricken city, and but for its great financial distress, the system would probably have existed to this day only in the reproduction of that article in the fifth volume of the published reports of this Association. Under ordinary circumstances it might have been regarded as a promising theory, but probably no town would have ventured on the experiment of putting it into practice.

As soon as the paper was read, its suggestions were caught at, as a possible saving straw, by the Memphis delegation at the meeting, and were by them urged on the attention of the commission of the National Board of Health charged with the sanitary questions at Memphis. The disastrous yellow-fever epidemics of 1878 and 1879 left that filth-sodden city partly depopulated, shorn of credit, and shuddering under a fear of the continuance of yellow-fever. As consulting engineer of the commission, I suggested the outline of a plan by which the system described could be applied to Memphis.

A sewerage plan on the combined system had some years earlier been prepared by Mr. George Hermany, C. E., of Louisville, with whom Mr. E. S. Chesbrough, C. E., of Chicago, had acted as consulting engineer. Mr. Hermany appeared before the commission in Memphis by its invitation, and urged the wisdom of doing only what had been done before. He expressed his interest in the scheme proposed, and in its trial as an experiment, but he could not advise its adoption as a practical system of town drainage. Mr. Chesbrough told me before the work was begun that he was glad that the system was to be tried, but that he himself would never have taken the responsibility of recommending it.

After long and thorough discussion, and mainly because it was the only thing that could be afforded, the commission, on the 26th of November, unanimously recommended this system to the authorities of Memphis. The plan, as suggested, included a large number of manholes, and rather large main sewers along the outlet valley. When the estimate came to be considered in detail by the council, it was decided, largely

by the advice of the mayor (Dr. Porter), to omit the manholes, and to make the mains only large enough for the needs of the next few years; the argument being used that, if manholes were found necessary, they could be built later, and that when larger mains should become necessary, the city could then better afford to build them. Dr. Porter especially urged these considerations as reasons why this system was best suited to the case. In plain English, the city could afford to do nothing else, and it could not afford to do even this completely.

A working plan was ordered. When submitted, it was actively discussed by the council, and was at length adopted. On the 28th of December, Dr. Porter called me to Memphis by telegraph, as there was a strong opposition to the plan. On January 1, 1880, I was cross-examined before the council for three hours and a half. It was decided that the recommendations should be presented to a meeting of the citizens, with the council's full endorsement. January 2, I discussed the matter actively, and against some very acrimonious opposition, at a large meeting in the hall of the Chamber of Commerce, with the ultimate effect of a strong affirmative vote, and only one voice in opposition.

From this time the work went on rapidly. Ground was broken for the laying of the pipes January 21, 1880. Early in June, it not being considered safe to disturb the soil during the hot season, the work was not allowed to proceed further. In twenty weeks, during five of which, in the aggregate, work was impossible because of rain, and during other five weeks was made difficult from the effect of rain, we constructed over eighteen miles of sewers, including all the main sewers, at a cost of about $137,000. This ended my connection with the original work, though I am the city's consulting engineer for sewers and all sanitary construction.

The work above described has been popularly credited with the conversion of Memphis from a pest-hole to a habitable town. What its exact effect may have been on the health of this city can never be determined. It may largely have caused it, or it may largely only have coincided with it. The paving of the streets and the improving of the water-supply have surely had great effect.

Mr. Odell, who was an engineer employed in the construction, wrote a paper for the American Society of Civil Engineers, giving a careful description of the system. He closed as follows:

> With the results already achieved by this small-pipe system of sewerage, it seems safe to predict that a new era has been inaugurated, and that the coming years will witness great modifications in the prevailing methods of sewerage.

This paper was the subject of much discussion, favorable and unfavorable. The criticisms related to the general applicability of the system, the conditions of Memphis being exceptional; to the superiority of the combined system; to the doubtful expediency of depending on self-acting flush-tanks, and of rejecting rain-water as a means of flushing; to the probable cost of maintenance; to the probable filling of sewers with

grease from sinks; to the absence of manholes; to the short distance below the flush-tank for which the flushing would be effective; and to the relative cost of the two systems.

Mr. Bogart said,—

If this system that has been adopted does not work at all, as has been prophesied, or only works for a short time, the fact that it is cheap will not make it economical; but if it does work for a few years, and even if after that time it does require additions, as, for instance, manholes, the beneficial results to the health of that city will doubtless be enormous. The fact is, that a system of sewerage has been put in at Memphis which Memphis was able to pay for, and I understand that, without some system of sewerage, there was a probability that the city would have to be abandoned as a place of residence.

Mr. Croes said,—

I do not understand that the entire separation of sewage and storm-water, which Mr. Waring advocates, and which has been carried out at Memphis, and recommended for Newport, Stamford, and other places, has been practised anywhere in England. In what is there called "the separate system," the rain-water from roofs and back yards is allowed to enter the sewer, but the street-wash is excluded. The Memphis work is attracting as much attention there as it does in this country, and the results of a continued trial of it are looked for with great interest. The omission of manholes does not seem to be a part of the "system." In this case it was an expedient adopted to reduce the first cost to the lowest possible point, in order to enable anything at all to be done.

In closing the discussion, I said,—

That it (the sewerage of Memphis) is by any means perfect in its details, I do not pretend. That these details will not be greatly improved by the efforts of others, it would be fatuous to suppose. Had I had more money to spend in Memphis, some of them would have been more complete than they are. At the same time, I am convinced that the main features of that system are strictly correct.

November 18, 1882, the city engineer of Memphis reported,—

The system, in the main, has so far worked admirably, and has given entire satisfaction;

And in November, 1886,—

Thus far no fault can be found with the manner in which the system has worked. The excessive quantity of mud in the water is our chief source of trouble. The small, ¾-inch supply pipes to the flush-tanks become clogged with mud. . . . . With clear-settled or filtered water all this trouble will cease, and the whole system work to a charm.

October 12, 1888, Mr. R. Frank Hartford, the engineer in charge of the sewers, wrote me,—

Your letter of the 18th ult., addressed to Mayor Merriwether, was handed to me for reply. Since it was given me I have had a thorough examination of the system made. Every line of sewers, whether of low or high gradient, is thoroughly clean. We have no fouling upon any line, and upon many I am certain that a velocity (mean) of not even 1½ feet is reached. On one of low gradient (1 in 200) in a distance of 700 feet the maximum depth of flow is not more than 2 inches (it is a 6-inch line), or perhaps 3 inches

with the flush; yet, even here, where the mean velocity cannot exceed 1.3 feet, the pipe is perfectly clean. We have, it is true, occasional stoppages, but they are invariably caused by foreign substances, such as sticks, rags, etc., never by deposit of sewage. With a good flush at the head of the line, I would not hesitate to lay 6-inch at 1 in 300, feeling confident that no fouling would occur. I should want to be sure of the flush, however, about once in twenty hours.

In his report of that year, this officer says,—

I earnestly recommend that a skilled inspector be employed to examine, test, and report upon work done under the plumbing ordinances. Bad work has now become the common practice, and it is clearly attributable to the lack of intelligent supervision.

How long this "bad work" had been the common practice is not stated, but in recent years there have been reports and rumors of an inordinate number of stoppages in the system, one authority placing it at 2,000 in one year, mainly, of course, in house drains, and due largely to a practice permitted among plumbers of forcing obstructions out of water-closet traps with plungers, driving forward into the drain and sewer masses of material which they were not intended to receive in such compact form.

The engineering officers of Memphis have taken great interest in the sewers of that city, and have applied, in recent work, a number of improvements. It is not unnatural that they should take to themselves the credit for the successful working of the system at large. It is a source of satisfaction to me that I was able to point out the line of procedure on which they have made such advance.

At the same time I am not willing that the obstructions which have formed in the Memphis sewers, and the "fungus" which is reported to have grown in some of them, should be laid to my charge. To what degree these defects have been due to negligent management and to defective flushing I am not in a position to determine, but there can be no doubt that defective construction, and the consequently defective operation of the flush-tanks, peculiar to Memphis, has withheld from these sewers the regular daily cleansing, which was, at the outset, provided as essential to their successful working.

It is doubtless largely due to more perfect flushing, and to improvements which have been engrafted upon this system in its later introduction elsewhere, that the experience of Memphis, in the matter of obstructions has been left quite unique, as would appear from later portions of this paper.

As the result of criticisms about Memphis, especially with reference to the great number of stoppages, I sent a circular letter to the engineers in charge of sewers in the various towns where I knew this system to be in use, as follows:

NEWPORT, R. I., November 19, 1891.

DEAR SIR: The statement has recently been made that the sewers of Memphis, Tenn., as constructed by me, have had during ten years 1,128 stoppages. In 1884-'86 there were said to have been 391 stoppages. The cost of removing stoppages was $11,006.10. The

cost, in the same period, of cleaning sewers was $6,178.08. The average length of sewer in this period was about 34 miles. It is stated that "in opening the older lines of the Waring system we found the entire pipe coated with a growth of fungus from ½ to 1½ inches thick, which could only be removed by passing steel brushes through the pipes, the usual flushing of the sewers not being able to detach this growth or prevent its accumulation."

The flush-tanks used on these sewers were the old form of Field tank, which soon became inoperative, partly from the silting up of the supply-pipes from the very muddy water-supply, and partly by the rust blisters on the inside of the descending limb of the siphon, these blisters catching the water and preventing it from falling free to the trap below. These defects have been repeatedly pointed out, but at last accounts had not been remedied. By reason of them, the sewers have been very inadequately flushed.

Will you do me the favor to give me your experience with your sewers in the matter of obstructions in the 6-inch sewers, of the growth of fungus therein, and of the general cleanliness and smooth working of the 6-inch portion of the system. Also, if you are willing to take the trouble, give me separately the mileage of 6-inch pipes, the number of obstructions, the cost of removing them and of cleaning the 6-inch pipes.

I am sorry to have to ask this favor of you, but I believe that the experience of Memphis has been entirely exceptional, that most of the obstructions occurred in house drains, that most of the obstructions in sewers resulted from the use of "plungers" in cleaning water-closets, and that the principal trouble is due to the failure of the antiquated flush-tanks in use there.

I should also like to know to what extent you have found it necessary to use a steel brush, or its equivalent, to remove fungus from the sewers.

Very truly yours,
GEO. E. WARING, JR.

I received replies concerning twenty-two different towns, from which I make the following extracts, covering the whole list, and giving the exact spirit of the reply in each case.

Omaha, Neb. (Geo. W. Tillson, Esq., C. E., City Engineer):

We have now 7 1-10 miles of 6-inch pipe sewers in operation, mainly in the residence portion of the city. On account of the number of hydraulic elevators in our large business blocks, we have relaid a number of sewers originally built of 6-inch pipe. In these sewers we did have considerable trouble with the fungous growth mentioned in the Memphis report. During 1887 we had three stoppages in the Waring system; in 1888, four; in 1889, four, and in 1890, twelve. During these years the mileage of the Waring system was greater than at present, as but little relaying had then been done, especially in 1887. Some of our residence lines that have been in use six or seven years, have never been stopped up, and others but once. Two lines in the business portion give practically all the trouble. We are not obliged to use steel scrapers to remove any fungus; in fact we have not dragged *anything through* the sewers for the past three years, though the sewer inspector occasionally flushes the sewers with the fire pressure. He says they might run all right without it.

Lenox, Mass. (T. Post, Esq., Sewer Commissioner):

During the past four years, while I have had the charge of the Lenox sewers, there have been but two stoppages of street mains, and those occurred on a short street, and very near together, and were caused by breakages in the main, the town having undermined the sewer main in constructing a large main drain to carry off surface water from a portion of the village. No trouble has been experienced on account of any fungous growth in our 6-inch sewers, or in any of our sewers, and all seem to work smoothly and to keep clean easily. . . . . We have about three miles of 6-inch pipes. . . . . We

purchased a steel brush, but it has only been used once, and then only to clear out a new street main after its completion and before commencing to use the main. Have never known of any obstructions in our 6-inch mains in the ten years of their existence prior to 1887.

Mr. J. H. Haney, C. E., of Little Rock, Ark., who has introduced the system in many towns in the South-west, says,—

I make occasional inquiries about my sewers, and am always told that they are in good order, work like a charm, and give perfect satisfaction and no trouble at all, but I have no information that can be statistically formulated. . . . . As to the accumulation of fungus in pipe sewers of small dimensions, I have never seen anything of the kind. I have seen heavy coatings of grease so deposited, which has the appearance of a white, spongy fungus, and a close-fitting wire brush would be the best means of removing this, as the most powerful flushing of cold water will fail to entirely remove such a deposit. While I do not question the good faith of the Memphis engineer who reports the fungous growth in the 6-inch laterals of that city, at the same time it would seem that the oldest 6- and 8-inch laterals of this city ought to be similarly affected. But it is possible that the old form of Field's siphon used so extensively in Memphis has become choked with mud and rust to such an extent as to become inoperative, so that a real fungous growth has appeared, and for lack of efficient flushing, has become too strong for removal by any other means than the brush. Such, however, has not been the case here, and we have quite a number of the old form of siphon, the same as used in Memphis, dating as far back as 1882, or only two years after the completion of the original Memphis system constructed under your supervision.

Mr. C. P. Bassett, C. E., says,—

On steep grades in Corning and Englewood 6-inch pipes were used, and the sewers have kept entirely free from stoppages. A fungous growth developed when the sewers were first placed in operation, but soon disappeared. . . . . I may also call your attention to the experience on house connections in East Orange. Here, for the first time I believe, connections were laid with the same care and under the same specifications as were the sewers, lampholes replacing manholes. In three years 10 miles of 4-inch connections—minimum grades 1 in 200—developed less than a half dozen stoppages, and these, with one exception, were removed by wire without digging up the pipe.

Lincoln, Neb. (Adna Dobson, Esq., City Engineer):

We have only about two miles of 6-inch pipe, out of a total of about twenty-two miles. The whole system is in good working condition, and during the past year we have had only five stoppages, all of which occurred in the 6-inch pipe. . . . . We have had no trouble with fungous growth, and all of our system is in a clean, smooth-working condition. We have had no occasion to use a steel broom or its equivalent.

Mr. Wm. B. Landreth, C. E., says,—

I have laid but one mile of 6-inch sewers, that mile being at Round Lake. I understand that the Round Lake 6-inch sewers have caused no trouble when well flushed, though a portion were laid on a 4-10 grade. I have had no trouble with sewer fungus, as it has always been readily detached by flushing.

Washington, Pa. (Albert Smith, Esq., C. E., Borough Engineer):

The length of sewers of the various sizes, completed to date, are as follows: 15-inch, 7,983.5 ft.; 12-inch, 1,719 ft.; 10-inch, 1,311.5 ft.; 8-inch, 9,316 ft.; 6-inch, 13,233 ft.; 4-inch,

12,466.5 ft; or a total of 46,029 ft., or 8.72 miles. The 12,466.5 ft., or 2.36 miles of 4-inch sewers consists of house branches (629 in number), which were laid to the curb by the borough and assessed on the properties. We have constructed 40 inspection chambers, 32 manholes, and 15 flush-tanks. These sewers have been in use from two to five months. So far the only obstruction which has occurred on the whole system has been that caused by an "oyster can" in a house branch, a thing which could only have happened through a flagrant violation of law and common sense on the part of the property-holder. There has been no instance of stoppage in any line of 6-, 8-, 10-, 12-, or 15-inch pipe, nor has one dollar been expended so far in cleaning them. . . . . As to fungus in pipes, I have been unable to detect any such growth so far, and there is but little sliming up of the sides of the pipes. A recent examination, embracing the opening up of about half the manholes, revealed only one at which the odor was perceptible at the street surface.

Mount Holly, N. J. (Geo. E. Gaskill, Esq., C. E.):

We have only had a stoppage in one street in the whole system, which was caused, first, by one of our plumbers opening one of the branches, and allowing it to remain over night, and while open a rain came and partly filled the pipe with sand; then about 500 feet above that point is located a large boarding-school, and the same plumber made the connection to the sewer from the school building, and must have left some large openings, from the articles that were found in the sewer-pipe—old shirts, house-cloths, and among other things a piece of wood as large as a man's arm, and 10 inches long. A 6-inch pipe would hardly carry such things very well. . . . . All other parts of the system have worked all right, and we have had no other stoppages of any kind. . . . . We have not had any occasion to use a brush of any kind, or to do any cleaning except the regular flushing. . . . . We have not been troubled with any fungous growth on the inside of the pipes, and we are very well satisfied with the system. We have in all about 3¼ miles of pipe, about 1,400 feet of which is 10-inch pipe, 2,806 feet of 8-inch pipe, and the remainder of the system is of 6-inch pipe. The total cost of the system, including survey, plans, my services superintending the work of construction, and your own services and expenses as consulting engineer, was $8,632.60 [$2,656.18 per mile].

Pullman, Ill. (Mr. Benezette Williams, C. E., sends the following quotation from an officer of that town):

None of the vitrified sewer pipes here have ever exhibited any traces of fungus, and they are as clean to-day as they were the day they were first put in. The scour is sufficient to keep these pipes clean. Not oftener than once a week, and sometimes at intervals of a month, one of the 6-inch block sewers will need a rod, and at rare intervals the stoppage has to be removed by digging up the pipe. The obstruction is never caused by sewage, but by foreign matter, such as cloths, old shoes, and, oftener than in any other way, by table-knives, forks, and spoons, which careless housewives must throw with other matter into closets. Children at play sometimes put blocks of wood in the closets; and such matter, as any one can readily see, is liable to clog a 6-inch pipe. In some cases we have taken out old quilts and clothes, as well as sticks and bricks which boys must have dropped into manholes. For their legitimate use as conveyors of sewage, I find our 6-inch pipes, as well as the larger ones, clean and bright. Even the ordinary flushing is very rarely necessary, the wash and scour of the sewage keeping the pipes clean. I send you some printed matter giving the lengths of pipe of various kinds which you put in here.

Mr. Williams adds,—

In looking over the printed matter to which Mr. Doty refers, I do not find the lengths of sewer at Pullman. My recollection is, however, that there are five or six miles.

Kalamazoo, Mich. (George S. Pierson, Esq., C. E.):

We have had no difficulty here commensurate with that at Memphis, as indicated by their reports. There is a slight growth of fungus in the sewers here, but before it attains any appreciable thickness the flakes of fungus become detached and pass onward to the outlet, so that the surface of the pipes are found practically clean. Very few of the lines have ever had anything similar to a brush passed through them, and some of them have been in use about ten years. We have never used any mechanical means other than the discharge from the flush-tanks for removing accumulations in the sewers, except in cases of solid substances causing stoppages. So far as I can remember, we have never had to exceed three stoppages in any one year which could not be removed by inserting a hose at the manhole or lamphole. The average cost of maintaining the system since its inception, previous to 1890, I find, by reference to the annual report for that year, to be $232.65. This includes removal of stoppages and a semi-weekly inspection of the sewers. Nearly all the stoppages have occurred in the 6-inch lines in the business part of the city. There has been scarcely any trouble with the 6-inch lines in the residence portion of the city. I think, however, the sewers in Kalamazoo have exceptionally good care on the part of the citizens. I have sent you by this mail a copy of the last annual report, from which you can gather the information you seek as to lengths of the different sizes of pipe, etc.

The schedule shows 31,055 feet of 6-inch sewers; that the construction of the system was begun in 1882; and that nearly one half of the system was built in 1882 and 1883.

Alameda, Cal. (V. M. Frodden, Esq., Superintendent of streets):

I took charge of the streets and sewers February 15, 1890, when I found that two of our receiving sewers were almost choked up, one with sand, and the other with mud and sand. Causes: some defective sewers which emptied into them, and improper care in looking after the sewers. The city had employed two or three men all winter to clean out these sewers, but with poor success. They would drag a sack of sand through these sewers from one manhole to the other, to get the sand out of the sewer. I saw right away that that did not do the work, so I had a steel wire flue brush made to drag through the sewer, and succeeded in cleaning both sewers thoroughly in about three months. I took hundreds of yards of sand out of these receiving sewers. That is how the steel brush came to be used in our sewers. These two receiving sewers are 12-inch ironstone pipe. We have about fifty miles of 6-inch sewers in the different streets. I never found any fungous growth in any of them. We have very few stoppages in our sewers, and the causes of any come from house connections, carelessness of householders in stuffing anything in water-closet drains, and in not using sufficient water to flush house drains. We have at present about two hundred flush-tanks in operation on our sewers, and they give good satisfaction. . . . . I do think that your system of sewers which we have in Alameda is a success. With proper care and sufficient flushing they can not be better. We are not troubled with sewer gas. The principal thing is to have the sewers well constructed, joints well cemented so that the sewer does not leak, and manholes every two hundred or three hundred feet apart.

El Paso, Texas (Dr. W. M. Yandell, Health Officer):

(1) In the four years that the sewers of El Paso have been in operation there have been not a dozen obstructions, which have been removed at a cost not exceeding fifty dollars. (2) There is no growth of fungus in the sewers. (3) The general cleanliness and smooth working of the sewers is perfect. (4) There were 7,543 feet of 6-inch pipes originally laid by you. Since then there have been laid 11,700 feet of 6-inch pipes; total 6-inch pipe, 19,243 feet. (5) Have never found it necessary to use a steel brush—in fact, the sewers have never needed cleaning at all. . . . . In fact, the sewer system is perfect.

Riverside, Cal. (Jas. W. Johnson, Esq., City Engineer):

The only considerable length of 6-inch pipe in use is about 1,900 feet at the end of one of the laterals. There is a flush-tank at the end of it, and but few connections along its length. It is in excellent order. We have a number of 200-foot lengths of 6-inch pipe running from laterals into alleys. They are laid with a flat grade, have no flush at the end, and occasionally require cleaning. A larger pipe would be no better. We find no fungus in the pipes.

Chelsea, Mass. (W. E. McClintock, Esq., C. E.):

There were about two miles of sewers built in part of Chelsea, Mass., during the summer of 1883. Perhaps a mile has been added to the system since that time. I have carefully observed the action of these sewers since their construction, at least to the time of my leaving the city work in April, 1890. My observations cover the whole length of the sewers and in all manholes. I cannot see but the pipes are as clean as they were after one month's use. There has not been automatic flushing since the first part of 1884.[1] Flushing has been had by means of letting on the water twice each month. There was no fouling up in the sewer except at the upper three hundred feet of dead ends. Our flushing removed all signs of fouling. The air was very good throughout, the system being only slightly polluted. We have about twenty-two manholes to the mile, and flushing as described at all dead ends. As I remember there are about 7,000 feet of 6-inch pipe, some of it laid on as flat a grade as 6 inches to the 100 feet. During my six years' care of these sewers I had two obstructions on the sewers, both on the 6-inch pipes. It cost us about $5 to remove both of them. One was a brick getting displaced in a manhole and falling down in the outlet. Obstruction removed by rods. The second was a stick getting in the outlet of a manhole and making a dam. Located by rods and removed inside of a half day after I had notice of it. We removed one grease obstruction from a 4-inch house connection by using the rods; time, a half day to find and remove. We never used any kind of brush, except as above described. The flushing kept all clean. I never noticed any description of fungous growth in these sewers. I think there were traces of a green growth on the bricks of some of our manholes, but not enough to do any harm. We have just put in five or six miles in Gardner, Mass. My assistant, just returned from there, reports evidences of a fungous growth in some of the sewers which we call "beggatoa." It is a spongy substance, whitish and of quite rapid growth. If it continues it may tend to fill some of the pipes. I shall watch it very closely, and if it continues to grow shall see what can be done to stop its growth. I think Memphis must be an exceptional case as far as this growth is concerned, and I do not think it would make the least bit of difference whether the pipes were six or twelve inches: they would fill up if it grows as fast as it starts off to grow in the outlet pipe of our Gardner filter beds.

Norfolk, Va. (Wm. T. Brooke, Esq., City Engineer):

We have in Norfolk about sixteen (16) miles of 6-inch sewers, portions of which have been laid at different times, covering a period of seven years. Therefore I have taken the number of stoppages during the last eighteen months only, as an example of our experience here. During the time specified we have had 126 stoppages, or an average of seven per month. These have cost us an average amount of $6.50 for clearing the pipes, or a total of $818, and a part of this amount has been expended in a general cleaning of the sewers in the neighborhood of each stoppage, so that it will be hardly fair to charge the whole to clearing the obstructions. The trouble we have found, in a large majority of instances, to have resulted not from any inherent defect in the sewer itself, but in a gross abuse of the purposes for which it was devised and intended, the last stoppage having been caused by some vagrant's taking off a manhole cover and throwing several

[1] Mr. McClintock means by this that the flush-tanks are not supplied by a constant stream. Twice a month the stopcocks are opened, and the tanks operate automatically until they are closed.

bricks into the line. Even then the bricks were carried a couple of hundred feet or more before they lodged. Again, it is a common thing to find yeast bottles, lumps of coal, razors, drawers-legs, segments of petticoats, door-knobs, old shoes, and such, at points of obstruction. I think, under such circumstances, that it is only a matter of wonder that more stoppages do not occur. . . . . Now as to the question of fungous growth in the sewers, and the use of the steel brushes. We have used steel brushes from the beginning, not only on the 6- but on the 8-, 10-, 12-, and 15-inch lines. These brushes I have found invaluable for removing the accumulation of sand in our flat graded lines,[1] and for cleaning the pipes generally. I am not aware, however, of there ever having been anything like a fungous growth in our sewers, and Mr. Miller (whom you know) assures me that he has had no trouble with or knowledge of anything of the kind.

New Castle, Pa. (J. H. Miller, Esq., City Engineer) :

With reference to the operation of the sewers in New Castle, constructed in accordance with the plan furnished by you in 1887, I would say that I think no system could give more general satisfaction. We have at present in operation seven miles of pipe sewers, two miles thereof being 6-inch pipe. The first use of the same was in 1888. The only stoppages thus far have been one on the 6-inch line and one on the 8-inch line. Cost of removing the former was $15.25, and of the latter, $3, making a total in three years of $18.25. You are probably aware that most of our flush-tanks are the Rhoads-Williams siphons. Our sewers, so far as I have been able to discover, and so far as reported by the plumbers in making connections therewith, are clean and in good condition. We have never used, nor found it necessary to use, a steel brush or any other appliance to remove fungus from any of our sewers, and I was very much surprised to learn of such difficulty occurring in sewers that were supposed to be regularly flushed. Perhaps we are congratulating ourselves too soon; possibly when our sewers have been in use for ten years we may have some trouble. We examine our flush-tanks once a month to see if they are working properly.

San Bernardino, Cal. (F. C. Finkle, Esq., C. E., City Engineer) :

I am sorry that I can say nothing favorable of our sewer system. The stoppages have been so frequent that we have not been able to keep track of the number, and the cost has been so great as to bankrupt the sewer fund of this city. We have taken up all 6-inch pipe and replaced it with 8-inch, which has remedied matters some. Fungus is growing in the sewers; especially was this the case with the 6-inch portion of the system. Our flush-tanks work perfectly, so that the difficulty is not blamable to them, and the gradients are good, being from one foot to two feet in each 100 feet. This city will never put in another foot of 6-inch sewer, the cost of keeping them clean is so great that it pays better to use larger pipes in the first instance.[2]

East Liverpool, Ohio (John G. Unkefer, Esq., C. E.) :

I was employed there by the board of sewer commissioners in the capacity of engineer during a period of eighteen months. The first six months were employed in sewer construction, and during the twelve succeeding months I had charge of the system, and superintended the plumbing work and construction of house connections. The length of the sewers is about ten and one half miles, 31,942 feet, or a little over six miles, being 6-inch pipe, and comprising the lateral sewers, which extend from the main sewer on thirty different streets, and through which nearly all the sewage must pass. At the upper end

[1] Nearly all of the sewers in Norfolk are laid in a very active and very fine quicksand, which finds its way through the smallest opening of the sewers.

[2] I have no knowledge of the plan under which these sewers were constructed, nor of the character of the work done. One or the other, or both, must have been singularly defective.—G. E. W., Jr.

or head of each line is placed a Field-Waring flush-tank of 150 gallons capacity, and by regularly flushing each line no trouble was experienced in keeping the sewers free from stoppages or growth *of any kind*. Not one cent was expended for removing obstructions (from use) in the 6-inch pipe during the time I had charge of the sewers. Neither a steel brush nor its equivalent was used to remove fungus. None was needed.

Wichita, Kansas (O. Mulvey, Esq., City Engineer) :

We have no 6-inch sewers in use here except some house connections, and therefore no stoppages in 6-inch sewers. Our smallest laterals are 8-inch, and since June 10, of this year, at which time I assumed control of the sewers since their completion, we have had only eight stoppages. The most of these were easily removed with the use of hose and fire hydrant. A few required the use of rods and scraper. Our system has been in use only since January last.

Keene, N. H. (P. F. Babbidge, Esq., Superintendent of water-works and sewers) :

When I assumed the office of superintendent, the sewers had been in use about five years. During this time but little attention had been paid to them, and no balls had been run through the lines at all. Of course I found the lines in rather bad condition, but had no trouble in cleaning them with balls and a liberal use of water, except in a few cases, where roots had got into the pipes through imperfect joints, or, as in one case, when we got a lot of bottles out. The fungous growth you mention I have never noticed in the 6-inch lines to any extent, or at least the balls have always cleaned it out. I have noticed the fungus in the large mains, but it has never caused any trouble to get rid of it. Our flush-tanks have always, and are now, working all right. I have done but very little work on the sewers this year and have not had a stoppage yet [November 20, 1891]. In 1890 it cost $386.60 to clean, repair, inspect all plumbing work that was done, and in fact everything in the shape of labor that was done on the sewer system, and we have thirteen and one half miles in operation. We have 53,906 feet of 6-inch pipe. . . . . The system complete to-day is as follows: 6-inch pipe, 54,106 feet; 8-inch, 2,745 feet; 10-inch, 1,380 feet; 12-inch, 3,852 feet; 15-inch, 9,065 feet;—total, 71,148 feet. The system is flushed by fifty-two Field-Waring flush-tanks, all of which work all right and keep the lines free and clean with the help of an annual running of balls through the pipes, which is done by three men in about two weeks at a cost of about $65. . . . . Eight hundred families (estimated) are connected with the sewers. . . . . The cost of maintenance for the year ending Dec. 1, 1890, was $823.53. This amount included the inspection of plumbing, all tools, and superintendent's salary. . . . . The whole system here is working like a clock.

Pittsfield, Mass. (W. R. Plunkett, Esq.) :

I can't tell, in answer to your inquiries, the mileage of 6-inch sewer pipe laid here: and the records of the different boards of commissioners were so kept that it would require some measuring to find out. I never heard that there was any fungus in our sewers. There have been times, not often, when the smaller sewers have been stopped by rags, shavings, or sticks. This generally occurs below where a new house has been built.

Stamford, Conn. (W. B. Pierce, Esq., C. E.) :

The number of stoppages recorded in Memphis gives it a remarkable record in more than the yellow-fever. One would almost believe somebody had been making a business of clogging the sewers for reasons of their own. . . . . Compared with Memphis our record is excellent. Since the first connection was made on Nov. 23, 1887, there have been but five or six stoppages in the whole system, and of these all except one were

in the 4-inch house drains. The exception was on Guernsey Avenue sewer, where, through a loose joint or cover, a quantity of sand caused a small obstruction, which four men removed in a couple of days. The house drains were all stopped by grease and other improper substances. No record was kept of the cost of removing obstructions. Our system is mainly composed of 6-inch and 8-inch pipes, there being about nine miles of the 6-inch and two miles of the 8-inch, in a total length of a trifle less than fourteen miles, the entire system. Whenever the Ys or manholes have been opened, observations have been made as to the clean condition of sewers. We have noticed a little fungus on several occasions, but not enough to ever cause any trouble. It is always at the water line, and detaches itself without any help other than the flushing. We have never had occasion to use brushes, rods, or anything else to remove it. We have never had occasion to clean any of the sewers except the Guernsey Avenue sewer already noted.

San Diego, Cal. No response has been received from this city, and I have no later information than that contained in the report of the superintendent of sewers to December 31, 1890, in which he says,—

Ten stoppages of the pipes have occurred within the year, and have promptly been relieved without great expense to the city and without serious embarrassment to the citizens.

The length of 6-inch sewers in San Diego is over thirty miles.

Mr. T. J. Graham, of Memphis, who, as a dealer in sewer-pipe, has kept close watch of the sewers from the first, and who was a member of the city council from 1882 to 1890, writes to my correspondent:

It is known that when Col. Waring's system was put in here it was the first general system of that kind ever put in, and while Col. Waring was here, from January to June 1880, a little more than 18 miles was built,—rushed through regardless of weather or high water, which seriously interfered with the proper laying of pipes. It would not be very wonderful if work done under such circumstances should show some defects as time goes on.

But the great matter that concerns the people of Memphis most is this: In the remedying of these troubles, that most vital of all the points in our system, *their sanitary efficiency*, has been overlooked or disregarded, and only the mechanical working of removing a certain sewage flow studied and provided for.

When Col. Waring came to Memphis, he found no sewers (except about four miles of private lines), and he found the earth's crust honeycombed with privy sinks, the number of which ran away up in the thousands. It was determined to clean out all the sinks, disinfect them, and then fill them with fresh clay; put in the sewer system, and also lay drain tile to prevent, as far as possible, the excess of moisture carrying the poison to the surface, and to facilitate the soil-cleansing process by the rain-fall carrying down to the drains matters deleterious to health, and by placing them below the grade of the sewers to maintain the sewer system free from disturbance caused by the bad soil in which they were laid.

The most important part, in fact the vital principle in the Waring system, is the Rogers-Field automatic flush-tanks, or the question of flushing. Anyone that knows anything at all about this system of sewers, is aware that they must be flushed regularly and often, or they become a curse instead of a blessing. They must be washed, or flushed at the least, once in 24 hours.

The flush-tanks here work automatically. The water used up to 1890 was muddy, and carried often as much as 40 per cent. of its bulk in sediment. This sediment settled in the tanks, so that it seriously interfered with the proper working, and for some time a man was employed to look after them and clean them out, but since 1890 we have had nothing but clean water "as clear as crystal."

The man that formerly cleaned out the mud from the flush-tanks was released, and

since that time, about one and a half years, they have been examined "semi-occasionally," and as I write, fully 50 out of 257 flush-tanks do n't work at all, and over 75 of them flush perhaps once in three or four days, and there are not over 150 out of the whole lot that work properly, principally because the castings are corroded.

This is what I call a lack of sanitary efficiency, and a want of sanitary appreciation on the part of somebody, presumably those in charge, and so far I think it can readily be seen that the fault is in the administration and not the projectors of the Waring system.

The obstructions, which have caused much fear in the minds of those who have been looking after the sewers of our city, are not the faults of the system, but arise from various causes, the principal one of which was that, when a stoppage occurred in a 4-inch house-drain, a plumber used to go with a long plunger, made to fit 4-inch sewer-pipe, and force out the obstruction, no matter what it was, into the lateral lines, where the city had to go to the expense of removing it.[1] Such things became so frequent that a plumbing inspector was appointed, and new laws made, and new rules drawn to govern such cases, and yet it is still difficult to prevent trouble of this kind in the older part of the city.

Another reason why the obstructions in Chelsea would never be anything like so frequent as in the older sewered portions, is that it is not so thickly settled, and the principal portion of the population is made up of people who own their own houses, and who would have to stand not only the expense, but the inconvenience, of such stoppage or obstructions, and therefore, as a class, they are much more intelligent users of the sewers, with their value, from a sanitary point of view, ever before them. Of course, any sewer serving such a population as this, would fare infinitely better in the matter of obstructions than sewers in the alleys of the heart of the city, largely used by an ignorant colored population.

Major J. H. Humphreys, who was for some time the principal assistant engineer at Memphis, who resides there, and who has, for the past twelve years, been much interested in sewerage work, writes that he thinks that experience has shown that economy requires the use of manholes, and that nearly all the stoppages were in the 6-inch pipes. He reminds me that he expressed the opinion in 1883 that 8-inch pipes should be used as a minimum. Concerning the defects developed in Memphis, he says,—

I cannot see how they detract materially from the credit which is your due for introducing here the separate system, which has been so extensively imitated by towns and cities in the United States. Nor do I see anything in the facts which constitutes an argument against the separate system as such. I am now more in favor of the system than at any previous time, both on economical and sanitary grounds. Would it not, on the other hand, have been without a precedent, if the system had been so perfect that experience could point out no changes that were desirable.

Accounts of the Memphis work attracted some attention in Europe. By request I prepared a paper for the Sanitary Institute of Great Britain, which was read at its annual congress. In the course of discussion Mr. Rogers Field said,—

I agree with the president that it would have been better if there had been manholes on the sewers. At the same time, there were several very special features in this case which altogether took it out of the ordinary category. Not a single old drain or street gully was connected with the sewers, and all the house-drains were strictly limited to

[1] Mr. R. Frank Hartford, for some time the engineer in charge of the Memphis sewers, told me personally, and one of his reports confirmed it, that the system was being seriously injured by such processes, and that he had been, thus far, powerless to prevent them.

4-inch pipes, so that nothing could get into the sewers that could not pass through a 4-inch pipe. All the service and branch sewers were automatically flushed every day by the discharge of the flush-tanks. The ventilation of the sewers was effected by an immense number of ventilating pipes, one of these being carried up every single house. *These conditions were altogether unprecedented*, and they could, therefore, hardly judge of the works by the rules applicable in ordinary cases.

Mr. Lavoinne, then chief engineer of the department of Rouen, wrote a paper describing the principles of the system, in the course of which he said,—

While understanding that municipal bodies should hesitate to undertake a general transformation which would devolve upon them expenses and responsibilities which now fall upon the owners of private property, it is nevertheless desirable that trials should be made in the new direction indicated by Mr. Waring. These trials would not be costly, and they might lead to the solution of a question at once important and radical and of the highest interest to the public health.

Mr. Lavoinne wrote me, privately, that the sewerage of the city of Memphis had solved the sewerage problem of Paris.

In 1883 a small section of Paris, in a district called "The Marsh," was sewered on this system by order of the public works department, under the direction of Mr. E. Pontzen. This work was described in a pamphlet entitled "Première Application à Paris en 1883 de l'Assainissement Suivant le Système Waring, par Ernest Pontzen, Ingénieur Civil. In this Mr. Pontzen says,—

The first application of sewerage according to Waring's system, made in Paris in 1883, in a quarter where all of the unfavorable conditions are combined, has been a complete success. The establishments drained by Waring's system leave nothing further to be desired in a sanitary point of view, and the *ensemble* of the drainage-works has not, during the five months it has been in operation, given rise to the least complaint. The water-closets in the court-yards are no longer offensive, and their presence would not be suspected; the conduits of the system have never required any special cleansing; no deposit has been formed in the collecting sewer in the Rue de Rivoli at the mouth of the main, and the air in this main, constantly renewed and passing only over recent matters moving in a rapid current of water, has no odor. The officers of the city and the members of the municipal council more particularly interested in the improvement of the sewerage of Paris have watched the experiment with interest, and I am permitted to say that the good services rendered by the combined arrangements introduced by Mr. Waring contributed largely to the influence which led the municipal council to decide, in its session of April 11, 1884, that the preliminary official inquiry which is about to be made, and which is the prelude of a definite decision as to the method of sewerage of Paris, should relate both to the direct discharge of household wastes into the existing sewers, and to their removal by separate sewers. . . . . This is one of the great advantages of Waring's system of sewerage, that it can as well be established in isolated sections, constituting an auxiliary and an economical complement of the great system of sewers, suited to receive fresh faecal matter and household waste, as it can, by itself alone, be extended for the complete drainage of whole quarters or of entire cities. Whatever may be the extension of a series of sewers according to Waring's system, it retains, always, by reason of its exclusion of storm-water, the great advantage of requiring only small diameters and reasonable inclinations in which the volume of flow undergoes only slight variations, and for the cleansing of which relatively small quantities of water suffice.

When the question of making an appropriation for my compensation came up in the city council, Mr. Alphand, the director of works, said,—

As to Waring's system, established in a quarter where the flow of matters is considerable, it has produced results. It was believed before that a special sewerage could not work in the sewers without the employment of suction or pressure. The trial of Waring's system has proved that by the simple natural fall of sewers, and by intelligent flushing applied to the water-closets, we may so dilute the matters as to render them sufficiently liquid to cause them to flow through pipes. It has been said that the demonstrations have not succeeded because during a period of trial three obstructions have occurred. Permit me to reply that this itself rather indicates success, because only three obstructions in such a considerable length indicate that the system has a real value. I want to say this very clearly, because by the terms of the report of the commission it might be thought that these trials have not been conclusive.

I am informed that this system is now used to a considerable extent in Paris, for the sewers of outlying districts, bringing them into connection with the large sewers.

Mr. A. Vescovali, chief engineer of the municipal service at Rome, wrote in 1885,—

You ask my opinion of Waring's system. I reply that I consider it excellent and preferable in practice to all of the more or less complicated systems that have been devised in these later times. I have proposed an application at Rome, but the municipal administration do not care to hazard a change from the old combined system that we have had since the ancient Romans. This system is, in fact, very good for us, because we have an abundant water supply which we can use without stint; but in the new quarters I think it would be well to adopt Waring's system with all its flush-tanks. This system would, in my opinion, be excellent if you could deliver its outflow at a distance in the sea, as you propose, but that, perhaps, would be difficult for want of fall. . . . . I still think it is preferable to all mechanical systems, wherever, because of insufficient water, the combined cannot act efficiently. I am a declared partisan of the combined system, which is the system used in Rome since its foundation. Our old and very imperfect sewers are a proof of the goodness of the system, because, with the abundant streams of water flowing through them, they are, in spite of their imperfections, free from objection and produce no bad odor. In the new quarters, on the contrary, although the sewers are better constructed and on a much better system, the odors are very troublesome. You know we have had to have recourse to periodic flushings with Field's siphon.

About 1888, Mr. J. G. W. Fijnje, one of the most distinguished engineers of the Dutch government service, wrote a paper on the sewerage of The Hague, in which he recommended the adoption there of Waring's system.

It is hardly necessary to refer to the great extension of the system here, several of our largest engineers occupying themselves almost exclusively with the construction of sewers for the smaller towns according to the system first introduced in Memphis, incorporating with it, of course, the improvements which the experience of the last twelve years had suggested.

It should be a source of satisfaction to the members of this Association to know that a process of sanitary improvement, which has secured such wide adoption, first originated in a paper read at one of its annual conventions.

(Since the foregoing was prepared for press the following have been received.)

Laconia, N. H. (S. B. Smith, Esq., Chairman of sewer commission):

The sewerage system put in by you, and now in use here, is giving perfect satisfaction. There have been no "stop-ups" and the flush-tanks have kept the pipes comparatively clean. I am especially pleased with the workings of the two main outlets and the "inverted siphon" under the Winnipiseogee river, with which we have had practically no trouble.

Stamford, Conn. (W. B. Pierce, Esq., C. E.):

The condition of the sewers in Stamford has not altered materially during the past year, except that more houses have been connected, and that we have put in two extensions amounting to about 1,400 feet of 6-inch sewer. After five years' use, the sewers are being cleaned for the first time, and during that period there has not been one stoppage in a sewer, and not more than a dozen in the house drains. Have been over about three quarters of the system, and find practically no deposit. To-day we have 555 connections.

XXIV.

PROJECT FOR STRAINERS FOR RAIN WATER IN THE STREETS.

By Dr. MANUEL URIBE,

Mexico, Mex.

Since the remotest times, the solution of the problem of draining and of the cleanliness of the great centres of population has justly occupied the attention of those who interest themselves in sanitary questions.

A multitude of systems have been proposed to reach this object, and from the time of the Romans small drains have been constructed to carry off all excrementitious matter from the cities.

The question of the pre-eminence of the system of canalization over that of fixed or movable deposits being solved, and the superiority of construction of combination drains being admitted—that is to say those that carry off, together with faecal matter, the water used for domestic purposes and rain water, over the *divisor* and *pneumatic* systems, which would be inapplicable among us on account of the great cost and difficult preservation and other circumstances entirely local,—our most vehement desire is to see the project of the drainage of our city realized by the combined system of canalization as preferable in a great measure to all others.

Our present network of small drains, defective from every point of view, and with none of the conditions of gradient and easy cleansing by the water, can be compared to a series of ditches of deposits, where the excrementitious matters deposited for a long time poison the air of the city with their pestilential emanations, which escape through the drainers.

In the time of rains it is enough to observe the bad odor, that even in the principal streets is so noticeable, to understand how necessary and urgent is the construction of a new system of drains based on truly scientific principles.

It is not many years since the waters of heavy rains, filling the drains suddenly and not finding an easy exit, dislodged the gases it found in the way and covered the sidewalks with a dirty and pestilent-breeding liquid. Faecal matters very often floated on the surface, and the flowing of these waters being extremely difficult, they were slowly dried by the sun, thus originating miasma, which, no doubt, influenced greatly the production of our habitual visitor, *typhus fever*. This was before the installation of the pumps of San Lázaro, thanks to which the water now

disappears rapidly in the rainy season; but under ordinary circumstances the deposits of excrementitious matter continues in the drain, and the fermentation abundantly produces gases, which escape through the present point of ventilation—the drainers of the houses and the streets.

Mr. Gayol in his recent project of canalization, presented to the corporation of this capital, indicates the convenience of constructing, on commencing the new drains, drainers to receive the rain-water from the streets, similar to those used in England, under the name of *gully*, and in Berlin and Frankfort under that of *schlamm-samler*.

These gullies, which we will briefly describe in order to make a comparison, consist of three principal parts (Fig. 1). First, there are openings placed in the stream or ditch close to the foot-path, below its curbstone, and covered with a casting grating movable round its axis; second, a vertical well of masonry 2.05 metres deep by 0.65 m. wide and with a crown of 0.23 m., sheet-iron boxes being placed at the bottom to receive and deposit large bodies, such as stones, rubbish, etc., which should not enter the drain, these being easily and rapidly extracted when the boxes are filled; third, one metre from the bottom of the well and consequently about half way up, a 0.16 m. tube, which goes through the wall of the well horizontally and afterwards curves up vertically, conducts to the drain the water which, after leaving the solid bodies, reaches its opening and empties itself automatically.

All the gullies are provided with a hydraulic lock made by a sheet of iron placed vertically in front of the opening of the tube, and about 0.06 m. away from it. A hinge on its upper side enables it to be raised by means of an iron shoot for the necessary cleaning.

This is prolonged a little lower than the entrance of the escape tube. When the level of the water reaches this sheet it completely prevents the escape of gases, the general arrangement of the system permitting the extraction of the sand and rubbish that fall from the street.

When these materials accumulate in large quantities they reach the mouth of the tube, impeding the escape of the water which rises and causes the stream to flood, thus warning the laborers that they must be extracted.

Mr. Gayol in his project modified the above arrangement, proposing the installation of strainers without hydraulic locks, "because among the rules for the maintaining of the drain system there should be one established that the deposit boxes should not contain water, especially in the dry season," for fear it should putrefy if left there too long, it being a difficult matter to change it frequently in the months when it does not rain.

Following this idea, the tube that carries the water to the drain is placed in the upper part of the structure without a valve of any description; and so that the gases shall not escape through the strainer, he shows the convenience of placing the wells of ventilation, those of inspection and those destined to receive the lamps, as near as possible to the emptying place of the rain sewers.

The construction of a new network of drains with all the proper conditions—impermeability, a fall, and an easy flow of water,—so as to realize the principle of *continual circulation*, united to the installation of adequate ventilation wells, would make hydraulic locks in the street strainers completely useless; but taking into account the difficulties of all kinds that would surely hinder for a long time the realization of a project of such magnitude, and considering the wretched state of the present system of street drainage, we intend proposing an economical system, easily carried out and which has, in our judgment, great advantages from a hygienic point of view.

As the street strainers are now made they consist of an opening in the drain covered by a paving-stone, with two wide transversal openings, below which a small vertical well terminates, forming a right angle in a sewer or square conduit, which carries the water to the highest part of the drain.

The said sewer, with a minimum inclination of 0.01 m. per metre, has not more than 0.04 m. of total fall, and the drains being generally full in consequence of their capacity being less than that required, the water remains stagnant, filling half or more of the sewer and keeping the level of the water in the drain.

There is not a strainer in which, on raising the stone, a black, pestilent liquid is not found, the emanations from which rise without any hindrance through the openings in the stone into the street. Unfortunately this deposit is much greater and even more offensive in the common cases, in which the flow is caused by the sewers of the houses themselves which simply have an opening covered with a perforated paving-stone below the curb-stone of the foot-path.

It will be easily understood how inadequate this system is, especially as the sewers of the houses are generally dirtier and more infectious than the drains. As will be seen, a remedy is needed for this system by putting hydraulic locks in the strainers, which will prevent the escape of gases, and by having the house sewers constructed separately from the street drains.

According to the last regulations of our Superior Board of Health, all houses should be supplied with ventilating tubes prolonged to the roofs, and by them the ventilation of the sewers can also be maintained until ventilation wells or tubes at a great height especially adapted for the purposes are constructed.

The system we propose to the consideration of this respected assembly, consists essentially of the following parts:

1. The opening place in the gutter under the sidewalk and covered with a movable sheet of iron on a strong hinge.

2. A square well made of paving-stones perfectly united one with another, and whose direction instead of being vertical should be strongly inclined towards the axis of the street where the sewer is placed.

3. At a certain distance this conduit changes its direction suddenly in the form of a V of unequal branches, whose angle, which may vary

between 95° and 120°, is constituted by the largest branch that comes from the grating and after a short distance inserts itself into the largest part of the drain.

4. In the angle thus formed a vertical stone separates the two branches, leaving between the lower part and the vertex of the angle an interval of 0.06 m. through which the water passes, descending with great velocity on account of the inclination, conquering the resistance of the second inclined plane and falling into a drain.

A certain quantity of water always remains in the V, contributing together with the trap to form a valve that completely impedes the escape of gases from the drain into the street.

The inclination and length of the largest branch can vary according to the depth of the drain and the distance from the sidewalk, but in general it would be better to give them the greatest inclination possible, in order that the calculation of the angle formed should allow a retention of water 0.1 m. deep in its deepest part.

The trap ought to run in openings situated in the walls, lateral from the conduit to 0.06 m. above the vertex of the angle, which permits it to be taken off at will in the remote case of obstruction, for the usual cleaning can be done by introducing a spade into the opening in the street and extracting any earth or rubbish that may have fallen in.

As with us there is not the bad habit of throwing all sweepings into the strainers in the street, as they do in Paris instead of having them collected by special carts; and the pavements not being strewed with sand, it is only in the rainy season that any considerable quantity of earth can be dragged into the gutters by the water, but this which happens now will not be any disadvantage to the working of the system, considering the quantity of water.

Stones, or any such large substances that may be dragged in, could not pass through the crevice, and if by chance this should be obstructed by mud, the water would tend to flow towards the street if the conduit were full, which would show the necessity of cleaning it.

As these strainers require very little water to act they have not the disadvantage of the large deposit boxes, in which a volume of water charged with organic matter becomes putrefied and throws out infectious gases.

It would be easy in the dry season to renew the water required in the strainers, arranging that when the street is watered a certain quantity of water should be thrown into the openings of the gutter.

I believe this system will give good results, preventing the stoppage of the water and exhalation of gases. Besides, it has already been put in practice for the first time in the declivity of the court-yard of the house of Dr. D. M. Hernandez in the city of Toluca, with perfect success.

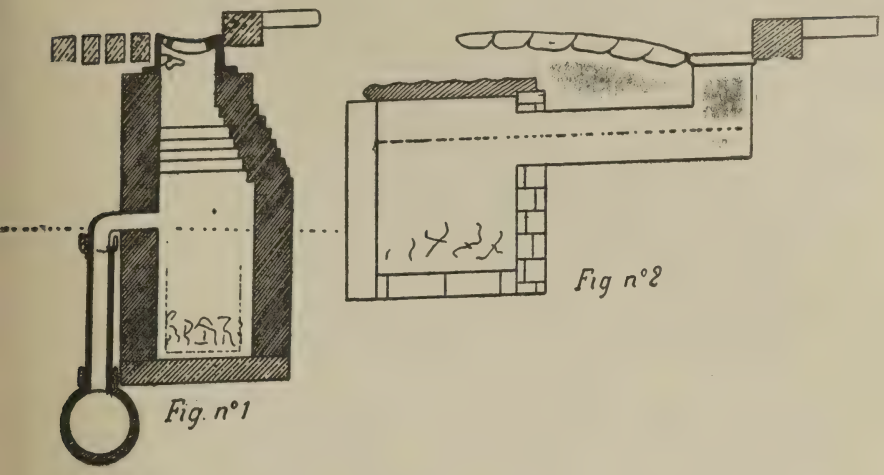


Fig. n°1

Fig n°2

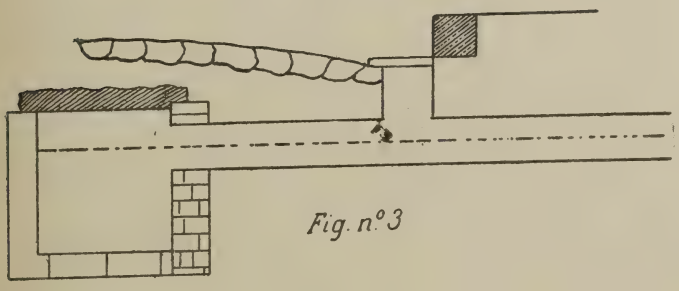


Fig. n°3

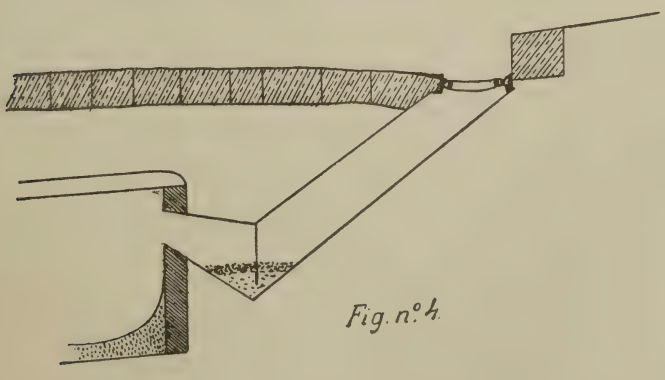


Fig. n°4

XXV.

A PERSONAL EXPERIENCE WITH SCARLET-FEVER, DIPHTHERIA, AND MEASLES IN HOSPITAL PRACTICE.

By Dr. SAMUEL E. MILLIKEN,

New York City.

While house-surgeon and resident in the Hospital for Ruptured and Crippled, of New York, where we had an average of one hundred and eighty (180) children, all of whom were from four to fourteen years of age and under treatment for some surgical trouble, epidemics of scarlet-fever, diphtheria, and measles occurred.

These children, coming mostly from the tenement districts of the city, and a large percentage at that time being afflicted with some tubercular joint lesion, caused us great anxiety for fear of a large mortality from the contagious diseases.

I shall only endeavor to make a few passing remarks on the methods adopted in our hospital for the purpose of isolation. No provision had been made at the time of building the institution for the care of such cases, other than to have allotted one small room for the temporary reception of any child who might develop a contagious disease, and when once the diagnosis was clear, the case would be transferred to one of the city institutions especially devoted to the care of such diseases.

For a time we practised the method of transferring, until the question of safety to the child was brought up, as not infrequently the patient had only recently been subjected to some grave bone operation.

There was no other way than to endeavor to isolate within our own building, and this at first seemed practically impossible. No greater task could have seemingly been undertaken than to establish such a quarantine,—as it finally so resulted.

The building was five stories high, and the uses to which each floor was put was as follows, ordinarily:

The first was for the resident staff and trained nurses, with our out-door department occupying about one third of the same, but fairly well excluded from the main stair-case (or stair-way).

Second floor was one large ward for the boys.

Third floor in a like manner for the girls. Off from each ward were small rooms for the reception of cases immediately after operation, others for dressing patients in, water-closets, etc.

Fourth floor was divided into a large school-room, where the children

were kept occupied for two or three hours daily, an operating room, rooms for the help of the hospital, and five medium sized rooms which had heretofore been occupied by private cases.

Fifth floor was a general play-room where the children were taken every afternoon for recreation, and one small isolating room which opened into a back stairway.

Disadvantages: It resolved itself into this,—that the fourth floor must answer the purpose of isolating three kinds of contagious cases.

The rooms opened into a common hall-way, which made very close proximity.

The source of infection was found to come from the children's laundry and clothing brought them by their parents once a week, and not until a quarantine against such clothing had been established did we cease to have new cases.

I had the individual care of all the patients so afflicted, and about fifty children were attacked during the epidemic. Of that number, not more than six had any two diseases.

The means adopted: When a suspicious case occurred in either of the wards it was immediately transferred to the small isolating room on the top floor.

When once the diagnosis was made, the patient was then transferred to a room on the fourth floor where such cases were kept.

After each suspected case had been taken from the ward everything was fumigated and allowed to air half a day before the well children were allowed to return.

The small isolating room was treated in a like manner.

Each set of cases had a nurse who was quarantined from the rest of the hospital.

Before entering any of the rooms where the contagious cases were kept, I took the precaution to put on a gown that entirely covered my other clothing. Afterwards I used strong bi-chloride of mercury solutions (1 : 2000) for my hands.

The mortality was very small considering the class of cases we had to deal with, and if I remember rightly, most of the deaths were when two diseases existed.

CONCLUSIONS.

1. With very poor facilities we can accomplish a practical and effective quarantine.

2. When in a large public institution, the source of the contagion or infection must first be learned.

3. By the proper precautions the physician can with safety prevent the contagion spreading if he will only protect his clothing and make free use of corrosive sublimate solutions on his hands.

4. In private practice no greater danger should be anticipated if prophylaxis is only observed.

XXVI.

PREVENTION OF OPHTHALMIA NEONATORUM.

By Dr. AUGUSTIN CHACON,

Mexico.

Public hygiene not only takes into consideration the prevention of the development and spread of those diseases, which, at the same time, impair the health and endanger the existence or lessen its duration, but also of those which, without compromising life, cause a serious trouble to the individual and consequently to society. Such is the case with those diseases of the eye which result in blindness. This is fully proven. The loss of sight not only deprives a person of a most precious gift, but affects the interests of social society in two ways: first, because a blind person cannot contribute his quota to public labor, and second, because said person, far from contributing to production, is a parasite upon the community,—living at its expense. Not only, therefore, from a humane point of view but taking into consideration the economical interests of society, it is of the greatest importance to avoid blindness, as we can much more easily prevent than cure the same, and it is to be desired that on subjects of such a nature, some attention should be bestowed by hygienic associations.

The most frequent causes of blindness are the different forms of atrophy of the optic nerve, and the purulent ophthalmia. I shall pass to the second, because the prophylaxis can accomplish much in preventing its development. I shall confine myself to the ophthalmia neonatorum. Magnus demonstrated several years ago that Prussia would save 8,000,000 marks a year, if the prophylaxis of purulent ophthalmia could be attained.

The causes that contribute to the propagation of this disease are,—

1. The existence of genital gonorrhoea. The hygienic measures that contribute to diminish this disease, will act in the same sense against ophthalmia neonatorum.

2. The existence of said purulent ophthalmia—that is, contagion. The curative means which produces its effect in the least possible time, will lessen the duration of the disease and the danger of contagion.

There are resources against the appearence of ophthalmia neonatorum, though the two first causes above mentioned may not have been able to be arrested, and although there may be deposits of morbid germs in the eyes of the infant.

At length, from a practical point of view, it matters little that the eyes

of the infant should contract purulent ophthalmia, could it be attended to in time, that is, on the supposition that the means employed should be capable of preventing any injury to the sight. This observation will be developed in due time.

The first cause of the spread of ophthalmia neonatorum, the existence of genital gonorrhoea, ought not to be treated by an oculist before intelligent members of this Association who make hygiene a specialty, and to whom its study more properly appertains, and I shall therefore overlook the same and treat the second, to prevent the appearance of the disease although the germs thereof may exist.

Purulent ophthalmia neonatorum is owing to the inoculation in the eyes of the infant of the virulent vaginal secretions of the mother. To counteract this possible inoculation, different means have been resorted to, which I shall barely mention, as they are so well known. In the first place, the vagina ought to be thoroughly cleansed before delivery, by means of some disinfecting liquid. The simple washing of the eyes of the infant with water, care being taken however that the water employed be not that used in the bath, has diminished the number of cases of ophthalmia in the hands of Königstein from 5.6 to 3.5 per cent. The antiseptic solutions of boracic acid, carbolic acid, and corrosive sublimate, are quite efficacious to disinfect the eyes of the infant. But among the preventive proceedings that which enjoys most credit is that of Crédé, which consists in dropping into the eyes of the infant just born, and after having been washed, a drop of a solution of nitrate of silver in proportion of 2 per cent. Crédé has seen the number of cases of purulent ophthalmia decrease by his process from 10 to ½ per cent.

Dr. Valude of Paris employs iodoform in an impalpable powder with the same object, blown in under the half-opened eyelids of the infant. The powder remains there, and produces a continual asepsis. This process is recommended on account of its simplicity and for its inoffensiveness, being, according to Valude, even more efficacious than Crédé's.

In a statistical report formed in the sections of Drs. Barr and Tarnier of Paris, it has been demonstrated that with this preventive method, the number of cases of purulent ophthalmia is one half less than with that of Crédé, and even when the disease breaks out, it loses much of its virulency.

The use of these prophylactic measures ought to be obligatory for physicians amd midwives who attend childbirth.

I have already indicated that the purulent ophthalmia of new-born infants offers, in the majority of cases, but little danger to the sight of the children, leaving perhaps small traces, if it is attended to in time by some intelligent hand. This can not be regarded, however, as a general rule, for there are some eyes incurable, whatever remedies may be applied thereto; but in a general manner it is certain.

It is true that not all cases of ophthalmia of new-born children are equally dangerous. We meet with some cases of simple conjunctival catarrh, the muco-purulent secretion, as well as the real purulent form

of greater danger produced sometimes by a bacillus described by the American bacteriologist Weeks, sometimes by the common micrococcus pyogenes and on other occasions by the gonococcus.

In infants, however, under the same circumstances it is less dangerous than in adults, because in the former there is not under the epithelium of the conjunctiva the layer of lymphoid cells which exists in adults, or if it do exist, it is very sparingly developed. This layer is very propitious to the spread of cocci.

It sometimes happens, however, in practice, that children are not taken to see the physician until the disease has made such progress that the sight is already injured forever; the cornea becomes ulcerated, is perforated, the iris prolapses therefrom and adheres, definitely resulting in a cicatricial staphyloma which scarcely permits a luminous perception.

This delay in consulting the physician depends on different causes upon which we must fix our attention. In the first place, the danger of the disease is not always understood;—among the poor and ignorant classes it is considered as a slight affection, as a harmless inflammation which will yield to household remedies, but later they are convinced to the contrary,—when the damage has no remedy.

It sometimes happens that the mother is so scarce of means that she can neither consult a physician nor take it to the dispensaries, for when the disease spreads, the mothers are in the first days of their lying in, and they have no one to take the infants to see the doctor.

It would be convenient to advise the parents of the danger the eyes of children attacked with purulent ophthalmia are in, and not have them believe in a false security, and to have printed on birth certificates which are issued by the civil registrar, this note recommended by the Ophthalmic Society of Great Britain and Ireland. "If the eyelids are red and swollen or form the site of a secretion some days after birth, the child should be taken to the physician without delaying one day. The disease is very dangerous;—if not cured in time the sight of both eyes may be lost."

It should be necessary besides, that the codes of health should make the declaration of every case of purulent ophthalmia for midwives, in cases of children of those women whom they attended, obligatory, and establish gratuitous domiciliary visits by physicians, paid by charitable associations, to attend to said patients. The establishment of free dispensaries and hospitals for patients with sore eyes, where new-born infants could be received and attended to, would contribute to the same object.

It were well to observe in this place the necessity under which all physicians labor, of having some knowledge of ophthalmology, and of having attended the lectures of diseases of the eye.

Every practising physician is under obligation to know how to administer the first attentions to children affected with purulent ophthalmia, upon which depends to a great extent the loss or preservation of the

sight. If afterwards he does not consider himself as possessing sufficient knowledge in that branch of medicine to which he does not dedicate himself preferably, he can recommend them to the care of a specialist.

I would be equally urgent, in opposing this scourge of ophthalmia of new-born infants, that the prophylaxis of this disease be taken into consideration by hygienic associations, and herewith I end my brief dissertation by recommending to you a study in your meetings of the matters the object of which is the prevention of the diseases of the eye and consequently of blindness.

In fine, the prophylaxis of ophthalmia of new-born children consists:

1. In procuring a diminution, and, if possible, the disappearance of genital gonorrhoea.

2. In avoiding the spread of the disease, though the eyes of the infant be already affected. Among the different processes which have been suggested for this object, those of Crédé and Valude are the most efficacious.

3. In causing the patients to be attended to from the first symptoms of the disease. Wherefore every physician should know how to cure it, and besides that, the parents should comprehend the danger in which the sight of their children is placed, and if they are scarce of means, that they should be treated gratuitously.

XXVII.

EPIDEMIC AND ENDEMIC DISEASES OBSERVED IN THE PORTS OF ENTRY OF THE MEXICAN GULF.

By Dr. LUIS E. RUIZ,

Professor of Hygiene in the National School of Mexico, Director of the Hospital Juarez, and Representative for the State of Morelos at the Meeting of the American Public Health Association,

Mexico.

The study which I have the honor to present to the American Association of Public Health in the name of the state of Morelos, is of such importance that its own value will assure me beforehand of the patience of the Association in spite of the deficiency of the work and my own slight knowledge of the subject.

I propose to divide my treatment of this matter under two headings, which will be a geographical and general description of the points referred to in this paper and a short description of the hygienic rules prescribed by the necessities and circumstances of the country.

I.

The Mexican coast on the Gulf of Mexico extends from the mouth of the Rio Bravo which forms our frontier with the United States of America, to Cape Catoche on the extremity of the Peninsula of Yucatan, giving a total length of 2,300 kilometres. The greater part of this coast is low, sandy, and swampy. We observe along its entire length abundance of lagoons running parallel with the sea, while on the coast of Yucatan we find long sand spits or shoals, which render navigation difficult near land. Although this coast is very long, it contains very few places adapted to the establishment of good ports, and still less are they adapted for the purposes of international hygiene. Nevertheless in the five states (Tamaulipas, Veracruz, Tabasco, Campeche, and Yucatan) which form the eastern coast of this country, we find nine cities with ports of entry, situated in the following order from north to south, viz.,—Matamoros and Tampico (in the state of Tamaulipas), Tuxpan, Veracruz, and Coatzacoalcos (in that of Veracruz), Frontera (in that of Tabasco), Carmen Island and Campeche (in that of Campeche), and Progreso (in that of Yucatan).

MATAMOROS.

[Founded January 28, 1823, by 3,280 Spaniards and half-castes and 580 Indians.]

Matamoros, which is a port of entry, is situated in 25° 52′ 45″, north latitude, and 1° 37′ 34″, longitude east from Mexico, and at a distance from this city of 1,075 kilometres. It is built on the right bank of the river Bravo, at a distance of fifty kilometres from its mouth, being bounded by the same river on the north and part of its eastern side. On this side also it has two lagoons, that of the Bravo and that of the Los Cuarteles. Its streets are wide and straight; its houses are generally built of brick, and the commercial buildings have very much the same appearance as those of the United States. It is mostly built on alluvial soil, mixed with clay and sand, with a covering of vegetable earth. Its climate is hot and damp, rain being abundant and the vegetation very luxuriant.

Endemics.—Paludism in all its forms is commonly observed here, and it is found that when the disease is contracted in Matamoros it is very rebellious against classic treatment. Among the diseases which are endemic in the locality, tuberculosis occupies the second place, and generally presents itself in the form that is called quick consumption, which is so terrible for young people. Dysentery, either in the primitive or consecutive form, is very frequent, especially in the beginning of the rainy season. Hepatitis, which is a consequence of the paludism and malaria of the locality, is also very frequently observed. Gastro-intestinal affections are also very common among children, and especially those of the poorer classes, their most common cause being the insufficient food; and lastly the catarrhal affections, above all in the mucous membranes of the nostrils and bronchial tubes attack many individuals, especially when they are debilitated.

Epidemics.—The city has been invaded by Asiatic cholera, yellow-fever, and influenza, the first and third of these epidemics having been imported from Europe, while the second was brought from Veracruz. We have also observed cases of eruptive diseases, although these are generally not very serious.

TAMPICO.

[Founded April 12, 1823, by 200 Spaniards and 60 Indians. It has a lighthouse with an elevation of 43 metres, visible for 20 to 22 miles in clear weather, and is situated on the left bank of the river Panuco 500 metres from the mouth.]

Tampico is another port of entry, situated in 22° 16′ 1″, north latitude, and 1° 20′ 19″, longitude east of Mexico, at a distance of 492 kilometres from the latter city, to which it is united by a railroad. It is situated on the left bank of the Panuco which bounds the town on the east and south, while on the north it is bounded by the Laguna de Carpintero and on the west by the Laguna de Chairel. It is situated on uneven ground, which in some parts rises to a height of four metres above the sea level and in others to eighteen metres. Its streets are straight, and

run north and south and east and west. It has a civil and military hospital, and the population is about 7,500 inhabitants.

The formation of the ground is alluvial, mixed with clay and sand which are covered with a vegetable mold. The climate is hot, the atmosphere damp, the rains abundant, and the vegetation exuberant.

Endemics.—Paludism, tuberculosis, dysentery, hepatitis, gastro-intestinal affections, catarrhal diseases, and climatic fever,—all, more or less, as in Matamoros.

Epidemics.—Cholera, yellow-fever, and influenza,—all proceeding from the same sources as in Matamoros. The drinking water is bad. The mortality is 68 : 1,000. There are occasional epidemics of eruptive fevers, but always limited.

TUXPAN.

This port of entry is situated in 20° 57′ 15″, north latitude, and 1° 43 52″, longitude east of Mexico, on the left bank of the Tuxpan river and at a distance of 10 kilometres from its mouth. On the north it has the hills of San Fernando, Campanario, and Palmar, on the east dense and beautiful forests, and on the west it is enclosed by the Tenechaco lagoon. Its distance from the city of Mexico is 310 kilometres. It has straight streets and houses of a good appearance. Its population is 4,700, and it has a hospital.

Its climate is hot and unhealthy, the mean temperature being 24° C., the extremes being 29° and 18.2°. The atmosphere is damp, the rains are very heavy, and the vegetation extremely luxuriant, while the drinking water is very bad.

Endemics.—Paludism, tuberculosis, dysentery, hepatitis, tetanus, catarrhal affections, and bites from poisonous animals.

Epidemics.—Asiatic cholera, influenza, scarlatina, and measles, also imported yellow-fever.

VERACRUZ.

[It has two lighthouses; one, called Juarez light, is situated within the city on the tower of San Francisco, at an elevation of 31.5 metres, and is visible at a distance of 15 marine miles, and the other on San Juan de Ulúa at an elevation of 26.25 metres, and distant from the other light 1,050 metres.]

This important port of entry is situated in 19° 11′ 51″, north latitude, and 2° 59′ 53″, longitude east of Mexico, from which it is distant 406 kilometres. It is connected with the capital by two railroads, the Mexican and the Inter-Oceanic. It is situated on the shores of the Gulf at an altitude which averages 2 metres above the sea level, the ground on which it is situated being uneven. It has straight and wide streets, which are generally well paved. Its climate is hot, the extremes of temperature being 34.2° and 15° with an average of 22°. The atmosphere is damp; the rains abundant, generally falling at night; the winds are strong, and commonly come from the north; the vegetation is abundant, and a few swamps are found in the neighborhood.

The drinking water comes from the river Jamapa. There are three hospitals in the city, of which two are civil and one military; there is one asylum for old people, and one for children. The population is 27,000. The town is well supplied with tramways.

Endemics.—These consist of paludism in all its forms, and are more frequent at the beginning of the rainy season, but when this season is over and the grounds begin to dry they take the form of pernicious fevers. Tuberculosis, generally of a pulmonary character is frequent, and its gravity increases in proportion as the temperature lowers in the first northers of the winter. Skin diseases are prevalent throughout the summer. Gastro-intestinal and catarrhal affections increase at the beginning of summer. Dysentery is found to be more prevalent during the heat of summer, and the same may be said of hepatitis. Tetanus is less frequent than the diseases above mentioned, and is observed throughout the whole year, being slightly more prevalent during the season of the southern winds. Yellow-fever or black-vomit is the most terrible disease which is endemic in this port, and generally begins with the rainy season, slightly diminishes when this is firmly established from the end of May to the beginning of October, and reappears in full force on the conclusion of the rainy season. During this season the natives are especially subject to a bilious fever which very frequently assumes a typhoid form.

Epidemics.—Asiatic cholera, influenza, and eruptive fevers. The first and second are of European origin, and the others belong to both continents.

COATZACOALCOS.

[It has a lighthouse half a mile from the beach, giving a white flash which in calm weather can be seen for a distance of twelve miles.]

This is a town and entry port situated in 18° 7′ 54″, north latitude, and 94° 27′ 7″, longitude west of Greenwich. It stands on the left bank of the river Coatzacoalcos, having an extremely hot climate, a damp atmosphere, a soil composed of clay and sand, a rich vegetation, very heavy rains and subject to the full force of the northers. It contains 500 inhabitants.

Endemics.—Paludism, tuberculosis, climatic fever, dysentery, hepatitis, gastro-intestinal affections, catarrhal affections, and yellow-fever, almost on the same conditions as in Veracruz.

Epidemics.—These are the same as in Veracruz.

FRONTERA.

[Lighthouse 23.23 metres elevation, situated at the mouth of river and visible 13 miles.]

This is a town and port of entry situated in 18° 31′ 43″, north latitude, and 6° 31′ 39″, longitude east of Mexico. It stands on the right bank of the river Grijalva, near its mouth. The climate is excessively hot, and the atmosphere very damp; the winds are very frequent; the formation is of alluvium with clay and sand, and for that reason is excessively

porous and full of swamps; the vegetation is exceedingly exuberant and of a thoroughly tropical character.

Endemics.—In this district the paludism affects the form of daily or tertian fever, but it also very commonly presents itself in the hypothermic form (41° and even 44° according to Dr. José M. Garcia) and during the period comprehended between September and February, when the northers blow in full force. It begins to prevail again during December when the swamps commence to dry up. Dysentery is found generally among the laborers employed in the cutting of woods. Rheumatism is prevalent during the rainy season, and principally attacks the poorer people. Hepatitis is also frequent, and especially among the laborers on the beach. Catarrhal affections, spotted skin (mal del pinto), and tuberculosis, although scarce are always to be found.

Epidemics.—Cholera of foreign origin, and yellow-fever imported from our own coast, and possibly from other points of America, are the principal ones, but cases are found of eruptive diseases.

ISLAND OF CARMEN.

[Founded under the name of Presidio de San Felipe, and on July 10, 1856, it received the title of city.]

Carmen, or Villa de la Laguna de Términos, is a port of entry situated in 18° 38′ 30″, north latitude, and 91° 51′ 10″, longitude west of Greenwich. It stands on the north-west point of the Island of Carmen. Its streets are straight, its houses built of wood, brick, and tiles, giving them an agreeable aspect. The climate is hot, the atmosphere very damp, and the winds regular. There is one hospital, and the population is 11,000.

Endemics.—Paludism prevails at the beginning of the rainy season and of the winter. Tuberculosis of a violent form is frequent among the poor people. Hepatitis, whether suppurated or not, is constantly found, although not very frequent. Dysentery prevails among drinking people. Gastro-intestinal affections are not rare, especially among children and people who do not attend to the rules of hygiene. Lastly yellow-fever is at times found, although at intervals of several years.

Epidemics.—Cholera has at times presented itself, coming either directly or indirectly from Europe; and there have been slight epidemics of yellow-fever and influenza, as well as eruptive fevers.

CAMPECHE.

[Founded October 4, 1540, under the name of "Villa de San Francisco de Campeche," and October 1, 1777, Charles III gave it the title of City. It has a lighthouse with an elevation of 28.72 metres over the sea level, carrying a fixed white light visible at a distance of ten miles.]

This is an important city and port of entry situated in 19° 52′, north latitude, and 8° 33′, longitude east of Mexico. It stands in a fertile coun-

try surrounded on the north, east, and south by low hills and on the west and south-west by the sea. The streets of this handsome city are exactly straight, and their direction does not coincide with the cardinal points of the compass, having a deviation of 20° from the latter. It contains one hospital and one asylum. The climate is hot, the atmosphere damp, the winds strong, and rains abundant. It has 16,000 inhabitants.

Endemics.—Paludism, tuberculosis, hepatitis, dysentery, gastro-intestinal affections, rheumatism and black-vomit (at long intervals) are observed in this town.

Epidemics.—Asiatic cholera, which in 1833 carried off the third part of the population; yellow-fever, which is sometimes imported from other ports of our own coast, and lastly influenza and eruptive affections.

PROGRESO.

[There is a lighthouse here with an elevation of 17.84 metres, and its white light is visible to a distance of ten miles.]

Progreso is a city and port of entry situated on the northern coast of Yucatan in 21° 30′, north latitude, and 90° 40′, longitude west of Greenwich. The climate is very hot, and the atmosphere extremely dry; on land the rains are variable, the country is poorly watered, and vegetation not very abundant. As the soil mostly consists of clay and sand, the heavy rains during the wet season form large pools and lakes which last for some time. The town contains 4,000 inhabitants.

Endemics.—Paludism in all its forms prevails without interruption in these parts. Tuberculosis, principally in the pulmonary form is observed, especially among young people. Although dysentery is scarce, it is at times found among people suffering from paludism, weakness, among the poorer people. Rheumatism, especially of an acute kind, is found among the agricultural laborers, and generally presents itself in the articulations. The black-vomit is much less frequent and deadly than in other parts of the coast, only presenting itself from time to time.

Epidemics.—A few instances of Asiatic cholera have been observed coming from abroad, and yellow-fever from our own coast, besides influenza and eruptive fevers among children.

In all these ports of entry, sanitary boards have been established in acccordance with Article 8 of the respective code.[1]

II.

Having sketched as above, and as extensively as is possible in a paper of this kind, the geographical and nosological features of the ports of entry on the Mexican gulf, I have now only to touch on the hygienic

[1]Article 8 of the Sanitary Code of the United States of Mexico is,—"The Sanitary Boards in the ports will be composed of one medical man who shall be appointed by the secretary of the interior on nomination from the Supreme Board, and who will act as president of his local board, of the captain of the port, and of the persons who may be appointed by the city council of the locality, and who are accepted by the governor of the state or political chief of the territory, 1891."

matters pertaining to the same, both as regards their being portions of my country and as regards their position in international hygiene, and the duties imposed on us by our position in the family of nations.

DOCTRINE.

The most deadly diseases are without doubt those which are transmissible, and these scourges of humanity are undoubtedly condemned to disappear by the irresistible force of the progress of modern hygiene. Clearly it is one of our first duties to care for the public, and to coöperate by all the means in our power to the consolidation of the science of hygiene, and to its progress and extension in practice.

With respect to the first part, the notable advance of knowledge on the subject has laid the foundation of the enormous improvement in public health. The ascertained facts have been organized by science, which through its study of experimental physiology has proved beyond a doubt the following important facts: that the large group of transmissible diseases is due to the penetration of living organisms (microbes) into the human system, which working according to their nature and in enormous numbers acquire a development in the animal economy that gives rise to the disease. These animal organisms have their period of incubation which is variable in the different species, but constant in the same nosological species, and which terminates in a series of symptoms which to a great extent present the same character as those of the bodies from which they proceed. Fresh individuals are contaminated and reproduce the same incubation and disease. The patient, if he dies, carries these diminutive organisms with him into the earth, where they generally remain as a standing threat of fresh calamities, or else he is cured, when a part of these micro-organisms is destroyed in his own body, and another part is thrown out into the atmosphere, where it forms another standing menace to humanity, infecting fresh individuals, and spreading the disease.

These microbes leave the infected organism, either in solid bodies as in the scabs of small-pox and scarlatina, or in liquids such as the saliva, expectoration, and the dejecta. In the first case they form part of the dust, and, floating in the atmosphere, adhere to the clothes and solid bodies, or they go into the water; in the second case they impregnate the clothes, and when these get dry the germs return to the atmosphere in the form of powder, or else they fall to the ground, where they contaminate the different classes of water and liquids which in different ways flow over the surface.

It is, therefore, easy to understand that these infectious powders can easily penetrate into the human organism, as is actually done, by the respiratory ducts. Observation has shown us that this way of transmission is limited and lasts but a short time, while if carried by the liquid or solid food they are more apt to develop in the body. Lastly, it is

well known that there are diseases which are specially propagated by the first way, others by the second, and others by both ways.

The tenacity of these germs is variable but certain, and when they are at liberty they only require favorable conditions of temperature and humidity to recover their primitive activity and become the fatal source of deadly epidemics.

These are the facts that are positively known as to this class of disease; and if it should be objected that they are only proved in regard to some of the transmissible diseases, while our assertions refer to them all, we can answer that it is really so, but that it is nevertheless certain that arguing by the most correct induction we are fully justified in applying to all, that which we find true with respect to some, of the same character, and that prudence imposes on us the duty of dealing with them all from the same prophylactic point of view.

PROPHYLAXIA.

Mankind has two great resources to which it can appeal to avoid the ravages of these diseases, and they are to avoid infection by them, or, if attacked, to conquer the disease.

Although the observations that follow are limited to public hygiene, it is nevertheless useful to note that individual hygiene being in the fullest sense of the word the first condition for the exact and thorough collective hygiene, we will assume it to exist in all cases.

With respect to the transmissible exotic diseases as viewed from the first point, we can and must appeal to two resources—to prevent the disease penetrating into the country, or, if it has penetrated, to destroy it in the place which has been invaded. In order to effect the first purpose, the authorities have generally made use of sanitary cordons on land and quarantine on sea. We will not discuss the first class of measures, both because our present study only refers to ports, and because it is now established beyond a doubt that that class of precaution is useless, and consequently has been substituted by others with great advantage.

With respect to the quarantine, we find that the nine ports of entry situated on the gulf require the establishment of a quarantine against cholera and yellow-fever, limiting ourselves to the recognized facts, and reducing the quarantine itself to the proportions that are strictly indispensable. When possible, the quarantine ought to be substituted by a sanitary disinfection, the thorough cleansing of the ship at its port of departure and during the voyage, and the isolation and treatment of the infected persons in a proper quarantine station. In order to render these measures practically useful aud successful it is necessary to follow the intelligent example of the Superior Board of Health in the measures lately taken on account of the threatened invasion of cholera, availing ourselves of four precautionary rules: first, that the consuls should give timely and exact reports with respect to the ships sailing for our ports; second, that in these ports the board of health or sanitary agents should

comply faithfully and correctly with that part of the legislation which refers to their duties; third, that the same sanitary authorities should execute their duties after receiving their orders from the supreme board of health, which will be given in view of the reports sent by themselves, and fourth, to construct two quarantine stations, one of which is already existing in Veracruz, and another one to be built in Campeche, in which establishments the precepts of hygiene should be rigorously observed.

In the cases where it has been found impossible to prevent the entry of the epidemic, we have a still powerful remedy in our hands, which consists in the rigorous isolation of the infected persons and a complete disinfection of themselves, their clothing, and their houses.

The detailed instructions for the carrying out of all these sanitary measures, form part of the duty of the superior sanitary authorities of the country; but the common interest and the present occasion demand that these regulations be dictated by the common agreement of the medical men who represent the enormous sanitary interests of the two republics of the United States of America and the United States of Mexico.

The above lines can be considered as referring more especially to theoretical hygiene, and we have now to take into consideration a few of the precepts of positive hygiene.

One of the causes that has most influence in the invasion and permanency of the great epidemics, is the insalubrity of the cities, and hence arises the necessity to cleanse at any cost the places in which humanity has congregated. The points to be attended to by the sanitary police are very numerous, but we have three that take a special prominence, viz., to drain the ground, to give an efficient system of sewerage, and to provide a proper quality and quantity of drinking water. To this we must add, that when an epidemic presents itself we ought, as far as possible, to diminish the density of the population and prevent the crowding together of people, either in their own homes or in public establishments.

Such are a few of the more important points, that with respect to the gulf ports on the Mexican coast, I have the honor to present to this Association.

XXVIII.

TYPHUS.

By Dr. AUSTASIO MARTINEZ,

Mexico.

In this paper I propose to give a brief resumé of my own observations of typhus fever in Mexico city, taken from the numerous cases which I have attended in the course of my private practice.

Typhus fever has assumed an endemic form in this capital. A few years ago it was only observed during the winter and spring, when it was found in full force, but disappeared during the rainy season; but for the last few years it has only decreased during the rainy season without disappearing.

It does not present itself as a rule in a form that is at once recognizable, but rather in an insidious manner, that at first is very apt to deceive the doctor who has not had practice in this special complaint.

Typhus fever very often commences with all the symptoms of an acute bronchitis, accompanied by a frequent cough and by pain and tightness of the chest; white and glutinous expectoration full of bubbles; on tapping the chest the sound is clear, and on applying the ear a stertorous breathing is heard, indicating an extensive mucosity with subcrepitant râles.

On other occasions it presents itself in the form of pneumonia, with intense pain on one side of the thorax, generally in the region of the mammaria, which extends itself towards the back, and whose intensity increases during inspiration, a strong dyspnœa, with frequent cough and blood-stained expectoration. On tapping the chest we very often find slight solidity in the sound, and on applying the ear the breathing is found to be stertorous and wheezing; but in these cases the expectoration is not of the character that accompanies pneumonia, but rather it is white with blood stains or streaks; tapping does not produce the solid sound, nor has the respiration the peculiar stertorous sound that characterizes that disease.

Typhus frequently presents itself under the form of an ordinary intermittent fever, recurring daily, either in the morning or in the evening. The patient is attacked by a more or less intense shivering fit, which, after lasting a little while, is followed by fever, and terminates in a general diaphoresis, which is followed by a complex apyrexia, the only continuous symptom being the cephalalgia and the pain in the limbs. After four or five days the fever assumes a continuous form, either spontaneously or as an effect of the action of quinine.

On other occasions typhus fever commences in the form of an acute articular rheumatism, accompanied by intense pain in the articulations, and especially in the legs, these pains being greatly intensified by pressure.

It also commences in many cases with an acute pharyngitis, accompanied by pain and dryness in the palatine cavity and in the upper back part of the pharynx, a more or less intense redness and pain, with difficulty in swallowing.

At other times typhus fever presents itself with all the symptoms of meningitis, an acute shooting pain in some part of the cranium, generally in one of the parietal bones—a pain which is intensified with every movement of the head, and is accompanied by frequent bilious vomiting, constipation, epistaxis, photophobia, delirium, restlessness, intense fever, thirst, and anorexia, but does not show the clonic convulsions nor the strabismus, which are so commonly found in the first period of meningitis.

In all these cases in which typhus presents itself in this insidious manner, making the diagnosis difficult in its first stages, there are two symptoms that are hardly ever wanting and that throw a great deal of light on the subject, and these are, a more or less profound stupor, acompanied by insomnia.

I will not at present treat of these other symptoms, but merely mention that when they present themselves the case always terminates fatally, and these are an exaggerated meteorism from the beginning of of the attack and hiccough.

During the first seven days of the disease one of its most frequent complications is epistaxis, which is sometimes so abundant that it can only be detained by stopping up the nostrils.

During the second period of seven days it is often complicated with hemorrhage of the intestines, hematemesis, in the case of women with metrorrhagia, and when they are pregnant it almost always brings on an abortion or premature birth, though that does not in any notable manner aggravate the symptoms of the disease. During this period of typhus fever it is also frequently accompanied by peritonitis; the evening chills are observed to be very persistent, and are followed by an elevation of the temperature, by an exacerbation of the symptoms, followed by diaphoresis, paralysis of the bladder and exophagus, a purulent gangrene in the sacral regions, and trocanteria in the toes, and in the case of women in the vulva, while in men it attacks the scrotum; sometimes spots of gangrene are formed on the abdominal wall and in the skin of the members; passive congestion takes place in the lungs, pneumonia, and in some rare cases, meningitis, diphtheria, ulcerated keratitis, otorrhea purulenta, and deafness supervene.

During the third period of seven days, when convalesence begins, the patient is liable to be attacked by parotigitis, which very seldom terminates by dissolution, by œdema of the inferior members, either both at once or one alone, by pulmonary tuberculosis, and, in my own prac-

tice, I have met with two cases of abscess in the liver at the end of this period, and one of cold abscess in the right leg. Up to the age of twelve typhus does not present itself in children as it does in adult persons, but is reduced to a continuous fever, which increases at night, restlessness and sub-delirium, which are sometimes complicated with diarrhœa, very rarely shows blotches, and almost always has a happy termination, unless otherwise complicated. In children the complication, which has been observed during convalescence, is coxalgia.

The progress of this disease is continuous and increasing, and whatever may be the form under which it presents itself, it takes, in the second period, the form of adynamica or ataxia, and more commonly that of ataxo-adynamica.

With very few exceptions it lasts for fourteen days, and when the termination is fatal, death ordinarily comes from the eleventh to the fourteenth day. If the patient recovers, convalescence almost always declares itself from the fifteenth to the eighteenth day, though the feverish condition may be very much prolonged. I have seen cases in which it has lasted twenty-five, thirty, thirty-six, forty, and forty-six days.

Its prognostic is very serious, and it is impossible to foresee how it will terminate. At times it has a very mild appearance, suddenly changing to a most dangerous condition, which quickly terminates in death. Many circumstances contribute to these changes, but the constitution and age of the patient have a specially great influence on the termination of the attack.

Of those who are taken with the disease between the ages of forty and fifty, almost half of the patients die; above the age of fifty they generally die about the eleventh day, and their convalescence is quite exceptional.

Typhus fever attacks all, without distinction of sex or age, but is more frequently found in the period of adolescence and early manhood, being rarer in infancy, and still more so in old age.

Sex has no influence in the progress, duration, complication, or termination of the disease.

Typhus is an infectious and contagious disease, a species of septic poisoning, which is endemic in this capital and its prevalence is in my opinion strictly a matter of climate.

The miasma of typhus is generated in all those places in which exist accumulations of animal or vegetable organic matters which have arrived to a state of putrid fermentation, and especially when these matters contain any large proportion of excreta.

It develops under the influence of these miasmas and is generally propagated by contagion, which is almost always direct, although some rare cases have been known of indirect contagion.

It is not as virulent one year as another, which is due to meteorological causes; in those years when the heat is excessive and rain scarce, the disease takes on a more violent form and the number of cases greatly increases. There is also some difference between the seasons, as it assumes a much graver character in autumn than in the other seasons.

Its contagious character begins from the sixth day when the spots appear on the skin, and lasts for twenty days after appearing. As I have been able to prove in many cases it is also contagious during convalescence, and persons who have not already suffered from this disease cannot with impunity enter into direct communication with convalescents until after twenty-five or thirty days from the declaration of that condition. The period of incubation is from one to fifteen days, but the disease generally makes its appearance on the sixth or eighth day after contagion has taken place.

Relapses are very rare, and repetition still more so.

There is no medicine which internally administered will prevent the contagion of typhus. If any medicinal substance has at any time appeared to fulfill this object I believe that the immunity was not due to the preservative action of the medicine, but rather to the absence of predisposition in the individual, for, as we well know, it requires a predisposition on the part of the organism for the production of the effects due to pathogenical causes, and the proof of this we have in our own persons, as we are daily visiting patients with infecto-contagious or infectious diseases which we very seldom contract.

In my opinion the best prophylactic to avoid the contagion or propagation of typhus consists in the isolation of the patient and in a strict attention to the rules of hygiene.

The patient ought to be placed in a room with only the objects and persons required for his own attendance, the air ought to be continually renovated by means of ventilation, the patient himself ought to be washed every day, and the clothing which he has used steeped in disinfecting solutions or boiling water, his excreta ought not to be left in the room, and with all these precautions very satisfactory results may be obtained.

The disinfectants which are commonly employed in the sick room are generally carbolic acid, chloride, iodoform, and others, but I consider them of very little utility, because in the first place they are among the least powerful of disinfectants, and in the second place, because the quantities in which they are used are insufficient to carry out their object.

On the other hand, typhus being one of those diseases which produce a radical change in the blood, it appears to me very much to be preferred that the patient should breath as pure air as possible, and not an atmosphere vitiated by the substances, which although medicinal, render it incapable of fulfilling the principal object of respiration, which is the chemical regeneration of the blood.

XXIX.

OBSERVATIONS ON THE IMPORTANCE OF THE AMERICAN ASSOCIATION OF PUBLIC HEALTH, AND ITS RELATIONS TO THE SCIENCE OF HYGIENE.

By MANUEL DE ANAYA,

Guanajuato, Mex.

The honorable president of the Mexican committee of the American Association of Public Health has honored me with an invitation to contribute a paper to this conference. I accepted this invitation with the greatest satisfaction, not in the expectation of distinguishing myself in a scientific manner, but because I fully appreciate the honor of belonging to a society formed by persons who are famous in medical science, and of participating in the elevated discussions which I will have an opportunity of listening to.

At the meeting of this respectable association in my beloved and beautiful country, I have judged it a good opportunity to enter into a general discussion of the vital importance of the noble and humanitarian objects of the association. This is the subject of my present paper, and I propose to treat it in the briefest possible manner, bearing in mind the short time allowed by the regulations to each speaker. My short discourse will consist of a summary of private opinions, suggested by the philosophical analysis of the influences which the natural sciences exercise in matters of public hygiene—philosophical considerations which I hope will be received with indulgence by the notable persons who form this illustrious body.

I.

The natural laws whose existence we recognize are not the real cause of the phenomena which we observe in the universe, but rather the expression or manifestation of their inevitable execution, and those laws human intelligence attempts to discover and utilize. A heavy body that is loosened from any height, invariably takes the direction of the centre of the earth; if we mix two substances whose molecules have any affinity to each other, a new body is formed. If a man receives a wound, pain is the natural consequence; charity produces a sentiment of gratitude, and a bad action engenders hatred. All these are inevitable phenomena determined by causes which we do not understand, attributed to the

properties of matter, whose existence is invariable and eternal. In the first case we say that the body in its fall obeys the laws of gravity, in the second those of chemistry are the ones which operate; and in the others we speak of the sensibility attributed to the laws of self-preservation. Our intelligence has to be satisfied with these vague explanations, which certainly are not very satisfactory, seeing that the true cause is for us a mystery, and our intelligence is strictly reduced to our sphere of action during our life in this world. Nevertheless, in the midst of this incalculable and perpetual succession of phenomena with such a distinct character, the intellectual world recognizes certain laws which enable it to direct its own actions and organize human society.

II.

Hygiene is the science which treats of the preservation of health, and its great importance to the life and well-being of humanity is, therefore, easy to understand. The human organization has at its disposal material elements, whose physiological functions are in continuous activity, and are indispensable for the preservation of the individual, while they are inseparable among themselves. They all recognize as the cause of their existence the natural forces which are inherent to the mechanism of the individual. The latter is formed in such a manner that he cannot exist without the help of the material elements which surround him, such as air, water, the earth, heat, and light, and he experiences the same transformations as all other animated beings. Science, which teaches us our true means of existence, presents it to us in the form of molecules which compose the universe in general, and in the social world it is the bee which fertilizes the flower of civilization. Undoubtedly man is the first of the animated beings on the earth. He gives himself the title of king, and with his ignorance and metaphysical traditions contrary to all science he has come to believe that the sole object of creation is for his especial benefit.

Nature, which is always constant in its prescriptions, sustains the existence of animal life by destroying or reforming the constitutional elements of the human individual; and death or the loss of health are the punishments imposed for the contravention of its wise and invariable laws. The circulation of the blood, respiration, and nutrition, are merely material phenomena whose fulfilment demand the compliance with the laws of hygiene, and if any disorder occurs in the physiological functions of the economy of the human body which sustain the general equilibrium, the healthy condition is suspended and disease appears. The causes of the latter are innumerable and demonstrate the fragility of human existence, whose sufferings, more or less intense, commence at birth and terminate at death.

Human intelligence is the force that produces human progress; its action, always productive, constantly enriches the world, spreading its benefits in all branches of learning. Each one of the human atoms con-

tains some portion of the sublime rays of divinity, which inculcate the preservation of the species in full plentitude of their vigor and health.

Hygiene, by scientific precepts, teaches us that the day has passed, when, following their ascetic traditions of scholastic discipline, it was necessary to despise science and torture the body; the debilitating practices of a contemplative life are incompatible with individual life, and are merely hallucinations, believed in by the ignorant, and in contravention to the laws which maintain the harmony of the whole universe.

III.

The provisions of nature are wise in themselves, but not sufficient to secure the well-being of the individual; his sex, his special constitution, his moral constitution, and above all his social condition, are powerful causes which exercise a great influence on his way of living. The man who finds within himself the necessary elements to give him a knowledge of the way to govern his own life is a rare exception, and must be considered a specially privileged being.

The laws which govern the development and preservation of the individual are the same which govern the material condition of society, seeing that the latter is nothing more than a collection of individuals. Nevertheless, if we look to the different conditions of society, public hygiene meets with innumerable difficulties, which oblige the authorities to afford the people a continuous protection in the series of transformations which are operated in animated bodies; inactivity is incompatible with the material and intellectual life of nations.

In the continual struggle for life, that which man conceives and desires for his well-being is a dream which cannot be realized. The struggle is always unequal, and nature continually presents to us innumerable enemies to health, while it provides us with very few elements for our defence. The diversity of climates, the human vicissitudes, full of caprices, the incalculable number of diseases which threaten his health, the terrible ravages of poverty, and the perpetual effervescence of the sensual passions, make of society a volcano in constant agitation; the individual will is exhausted in vain efforts, and the sentiment of good is dissipated like a drop of honey in the salt waves of the sea.

History shows us that the genius of war, as represented in the person of the conqueror, imposes its will on the subjugated people, moves powerful armies in the way it thinks fit, and carries desolation, death, and pain over the lands which it traverses; destroys all obstacles in its way and reaches in a rapid manner the ephemeral triumph of arms; dominates the conquered people, and is accorded the admiration of the entire world. The science of hygiene, which is sublime in its results, has to struggle against terrible adversaries, and as a general rule, only receives a half-hearted protection on the part of the authorities, especially considering its elevated mission in the regeneration of society; and therefore it is that its highest efforts only meet with a tardy coöperation in its praiseworthy efforts for the preservation of public health.

IV.

From a purely mundane point of view, the study of hygiene is very important to the evolution of humanity; it examines and records the succession of the phenomena which are constantly operating in the human organization, with the object of establishing by its scientific precepts the most favorable conditions for his well-being and health. Metaphysical questions are entirely foreign to this study, at least as far as they do not effect the preservation of the human species. Its humanitarian objects will not recognize religious differences, and its purpose being to prevent the ravages of public calamities, of vice and misery, it foresees the evils that may be originated by prejudice when these may favor individual inertia and prejudice its own development and improvement. The intimate relations which exist between the body of an individual and his moral disposition, determine modifications of the highest importance in human society.

Consequently, the hygienic conditions which control the physical development always exercise an inevitable and beneficent influence on the improvement of society as well as on the persevering activity of human thought. Its sanitary provisions do not only occupy themselves in giving to society benefits of a tangible form, as if treating of an architectural monument with recognized merits and fair proportions; no, death carries off the individual, but the state is permanent, and always has representatives to exercise its power and demand the support of the intellectual world.

As a general rule, science, arts, and industries impart their benefits without finding enemies against whom to struggle. Hygiene, on the contrary, has to struggle against terrible adversaries as above shown, who are continually threatening the public health. Its infallible precepts constitute in administrative law the basis of an indispensable legislation, whose noble object is the improvement of society by the purification of its customs. The American Association of Public Health, which extends its relations with the medical societies of our beautiful country, reveals the intellectual movement corresponding to its own greatness—its precepts are not the ancient propaganda of fruitless or mistaken doctrines which enslave thought, but the transmission of scientific principles which form the foundation of a social regeneration.

The philanthropic objects which move this honorable Association, accepting as an infallible axiom that "prevention is better than cure," form a real triumph, showing the world that science considers the entire humanity to be its country, and spreads its important influence over the people who cultivate it; its dictates, which are all of public interest, strengthen the relations between individuals, without distinction of race or nationality, by means of the sacred bonds of a true fraternity.

If the effervescence of sensual passions frequently produces terrible disorders among peoples, science, on the contrary, by the sublimity of its

precepts, is the sacred benediction of Providence, which always struggles for peace, union, and concord, animates the heart for the work of charity, and contributes to the moral perfection of humanity by its results of general interest. In conclusion I must say that the meeting of this illustrious body in Mexico could not have taken place at a more opportune moment. The civilized nations of the old continent are enthusiastically preparing to celebrate the glorious anniversary of the discovery of our new world by Christopher Columbus, and in this universal movement of modern civilization, the new world shows itself to the eyes of contemporaneous nations, occupied with the organization of philanthropic institutions, proving that the true law of prosperity in nations resides in the science which illuminates and in the sovereignty of human intelligence.

XXX.

MEMORANDA RESPECTING THE PALUSTRIC INFECTION IN MONTEREY.

By Dr. RAFAEL GARZA CANTU,

Monterey, Mexico.

Gentlemen: The object of the memoranda which I have been able to bring together, relative to palustric infection in Monterey, is to show the beneficial influence of hygiene. They are certainly very incomplete, but even in that condition, I believe that they can be made useful to science in the enormous work of generalization which constitutes its force and its greatness. I leave the task of completing them, and the still more arduous task of discussing and developing the medical doctrines which refer to this matter, to older and wiser heads than mine, and I only want to present in a clear and explicit manner the phases which are presented by the palustric poisoning in Monterey, the specialties found in its climate, soil, and waters, and the beneficial influence which has been exercised by hygiene with respect to the symptoms of poisoning in that locality.

In the first place we have to note the traditions and history of this question, and indeed we find that traditions exist showing that palustric infections have always been prevalent in that city since its first establishment, although we have no documentary evidence respecting the period immediately following its foundation, with which to prove these assertions. Nevertheless, we have a strong argument in its favor by analogy, and that is, that no change having taken place in the disease within historic time, or in its medical constitution, except by such measures of hygiene as are well known, and the climatic conditions not having in any way changed, we cannot but believe that the causes existed which produced the effects which we now observe.

The earliest written data that we have relating to the public health of that city are decidedly vague and undefined, such as the writings of Dr. González Candamo, who wrote towards the end of the last century, as follows: "The climate of Monterey is warm and damp, and consequently, unhealthy," but in the present century we can follow this palustric disease step by step, observing its epidemic accesses which generally come every eight years, but sometimes with an interval of even thirteen years.[1]

The first epidemics of which we have any knowledge, were attributed, and probably with reason, to the building of certain large dams in the

[1] See appendix, note 1, p. 206.

year 1799, of which remains can be seen to this day, and the object of which dams was to facilitate the passage of the waters which traversed the northern part of the city from east to west, as well as to irrigate the fields situated in that district; to a large volume of water which was carried in open ditches to a great many houses within the city, and which in seasons of extraordinary rain often caused floods, and, lastly, to the swamps that were continually being formed in the neighborhood of springs and streams.

These epidemics were repeated several times, from that which occurred in 1802 and which caused the death of five hundred out of seven thousand inhabitants which Monterey then had, within the space of a few months, up to that of 1844; and during this period of 42 years the source of the evil having been discovered, the dams were ordered to be destroyed, the excess waters drained off, the ground levelled so as to avoid the formation of pools of stagnant water, and the general sanitary conditions of the city so improved that we have not had any other case of a real epidemic until the year 1866.[1]

This last epidemic, which was coëxistent with some cases of Asiatic cholera, is shown in the adjoining diagram, which gives the movement in the González Hospital, from the date of its foundation until the present day, of the patients admitted suffering from palustric fevers,[2] and although this epidemic was very mild in comparison with the previous ones, it was sufficiently dangerous and deadly, and fully justifies the hygienic measures taken by the board of health at that time, ordering the drainage of all swamps which were continually forming on the sides of the stream of Santa Lucia, with an area of nearly a kilometre, and ordering at the same time the canalization of the waters that flowed in natural water-courses. Unfortunately these improvements were not effected at once, but delayed till the years 1886 and 1887.[3]

With these improvements, which are only alluded to in the sketch of the history of the endemic in Monterey, the general health of the city, and that branch of it in particular, has greatly improved, and although we still lack full and complete medical statistics which would include a sufficient number of years to enable us to make strict comparisons, we can now feel certain from the data we possess that Dr. José Eleuterio González was not wrong when he asserted in the year 1873, after having initiated and obtained these hygienic improvements, that, "the drainage of the swamps and the canalization of the waters in its water-courses will improve the public health of the capital of Nuevo Leon, fifty per cent."[4]

But to what special element—whether hypsometric, abtermic, a special constitution of the soil, or the quality in the composition of the waters—can we attribute the special medical constitution of any locality?

[1] See appendix, note 2, p. 206.
[2] See appendix, note 3, p. 206.
[3] See appendix, note 4, p. 206.
[4] See appendix, note 5, p. 206.

I do not believe that I can myself determine this question, but I have tried to study it from the point of view of the topography, temperature, constitution of the soil, and composition of the waters of Monterey, so as to find out if possible the truth of the doctrine which many sustain, that the so called telluric miasmas, among which the palustric occupies an important place, have their origin outside of the human body, in contra-distinction to those which produce typhus and typhoid, and which appear to be exclusively domiciled within the same. That, at least, is the opinion of respectable authorities.[1] In this manner they have indicated the course that has always been followed in the etiological investigation of palustric infection.

The capital of Nuevo Leon is situated in a valley formed by the spurs of a mountain chain called the Sierra Madre; it is situated in 25° 40″ 16′, north latitude, and 1° 20″ 15′, longitude west of the meridian of Mexico City. Its elevation above the sea level is 495 metres. The barometric pressure varies between 0.707 m. and 0.725 m.

The mean temperature throughout the year is 23° C. The months of highest and lowest temperature are July, with a mean of 31°, and January, of 12°; but one of the special points in the climate which most attracts the attention in Monterey, is the extreme and continued oscillation of its temperature. In this way it varies greatly from one year to another, in the months of the same year, in the days of the same month, and even in the hours of the same day. For example, in the month of January, whose mean temperature is, as I have before said, 12° C., the temperature has lowered in some years, and for several days at a time, to 9° below zero; while in some years it is not uncommon to find it at 1° or 2° below zero; on other days the observations range from 16° to 20° above zero. In the month of July also, the temperature often ascends to 41° or descends to 20°, the mean temperature being 31°.

According to observations taken in the Civil College of that city, which can only be considered as approximate and not as a faithful representation of the facts, for the reason that they only include a small number of years, we have a minimum of 39 rainy days in the year and a maximum of 89. The month which has the greatest number of rainy days is September, with an average of 18 days. The average rainfall throughout the year is 3,000 cubic centimetres per square decimetre of surface.

The prevailing winds are from the north, east, and south-east. On rare occasions we see hurricanes, which only take place during the heated term of summer, when, as in all hot climates, rapid condensations of vapor are formed, which violently break the equilibrium of the atmospheric strata, causing the rare but violent tempests which take place in May, June, and July, exclusively.

The valley of Monterey is almost circular, and is divided by a line of hills stretching from east to west; it is also open to the north and north-east, where it spreads out into an extensive plain. The surface of the soil

[1] See appendix, note 6, p. 206.

is uneven and its composition varies little ; of the three formations, igneous, metamorphic and sedimentary, the last class is the one which prevails ; only slight traces of the two former ones being found on the hills which bound the valley towards the west and north-west in the form of granite, porphyry slates, and an abundance of crystallized limestone. The soil throughout the district is generally composed of a thick stratum of marl through which the waters escaping from the city readily penetrate, and which, as can be seen on the side of the hills near by,[1] has a variable depth in the centre of the city. It is found at a great depth in the place which could be technically called Thalbeg, where the most remarkable springs rise to the surface and flow along their courses, such as the spring called Santa Lucia and others, while the same stratum is hardly covered by a thin coating of humerus in the higher altitudes.[2]

Towards the north and north-west this stratum is hidden by another of clay, suitable for the manufacture of earthen-ware, which is highly charged with oxide of iron, and to the south of this we find a formation several kilometres in length, about 100 metres in width, of alluvial earth in which is the bed of a small stream showing a sand of quartz formation mixed with small fragments of feldspathic and limestone rocks, besides water-worn stones of carbonate of lime vulgarly called bluestone.

From the light sketch above given, it will be easily understood that the soil of the city is greedy of water, porous in many places, and consequently generally susceptible of infiltration. On the sandy and clayey soils we find an abundant vegetation of leguminosæ, papaveraceæ, salicineæ, cupuliferæ and other plants adapted to these soils, while the valley bottoms are covered with palms, cacti, and other plants adapted to the low lands, and the streams give life to bamboos, water cresses, and other aquatic plants.

The science of cosmology has shown us that the issue of waters is due to the different effects of pressure, and to a system of canals or hollows which communicate among themselves—a phenomenon so frequent on the land that in some parts the water springs up even in the depths of lakes, and in others on the ridges of steep and high mountains.[3]

This general truth is further proved in the valley of Monterey, where the water is seen to spring on the tops of elevated hills, as well as in the bottom of the valley, in quantities sufficient to irrigate a large extent of the adjoining country.[4] If these waters were to be classified according to their origin, they would all be classed as meteorological. The springs are constant and cold, their temperature ranging from 21° to 23° with the exception of those of San Bernabe (Topo Chico) at the foot of the mountain which bears that name and which are permanent, but at the same time, warm, sulphurous and consequently geological.[5]

[1] See appendix, note 7, p. 206.
[2] See appendix, note 8, p. 206.
[3] See appendix, note 9, p. 207.
[4] See appendix, note 10, p. 207.
[5] See appendix, note 11, p. 207.

All of these, with the exception above indicated, are dedicated to domestic purposes in the city, and, as can be seen in the adjoining table, which shows the quantitative analysis made in July of the present year.

QUANTITATIVE ANALYSIS OF THE WATER IN DOMESTIC USE IN MONTEREY.

Organoleptic Character.

All are transparent, inodorous, and have an agreeable flavor. All these analyses were made in my presence by the assistants of the Chemical School of the Civil College, Eusebio Guajardo and Ernesto Videgaray.

Water from public fountains (in one litre).		Spring water from "El Ojo de Agua" (in one litre).		Well water (in one litre).	
Temperature,	23°C.	Temperature,	23°C.	Temperature,	23°C.
Total hardness,	20°Hid.	Total hardness,	23°Hid.	Total hardness,	28°Hid.
Permanent hardness,	10°Hid.	Permanent hardness,	12°Hid.	Permanent "	25°Hid.
Differential hardness,	10°Hid.	Differential hardness,	11°Hid.	Differential "	3°Hid.
Sulphuric acid,	0.036	Sulphuric acid,	0.0116	Sulphuric acid,	0.045
Chlorine,	0.004	Chlorine,	0.0048	Chlorine,	0.008
Silica,	0.006	Silica,	0.010	Silica,	0.020
Lime,	0.050	Lime,	0.070	Lime,	0.090
Magnesia,	0.008	Magnesia,	0.010	Magnesia,	0.074
Alkaline metals,	0.001	Alkaline metals,	0.002	Alkaline metals,	0.010
Oxygen consumed by organic matters,	0.0014	Oxygen consumed by organic matters,	0.0011	Oxygen consumed by organic matter,	0.002
Ammonia,	.....	Ammonia,	.....	Ammonia,	.....
Total residuum,	0.136	Total residuum,	0.146	Total residuum,	0.240
Organic matter,	0.028	Organic matter,	0.031	Organic matter,	0.040

They are also of good quality, the total residuum per litre varying according to the spring from which it has come, from 0.160 grammes to 0.240 grs., whereas the outside limit that such respectable authorities as Duvouxquet and Latorgier fix as the hurtful proportion is one gramme, Monin stating it as 0.50 grs. for a minimum. With respect to the amount of oxygen consumed by the organic matter, which was determined in this case by following the process advised by Kaubel, it did not exceed 0.002 grs. and 0.003 grs., which are the proportions indicated as a maximum by the same authority. The amount of organic matter was also determined under the supposition that it is twenty times that

of the oxygen consumed, with the result that the impurest of the Monterey waters, those proceeding from the wells, only contain 0.04 grs. in one litre, the limit of impurity being 0.05 grs.[1]

An inspection of the above mentioned table will also show that, of the three kinds of water used in the city, spring water, water brought through iron piping, and well water, the last two are the most impure, both for the amount of foreign matters which they contain and for the amount of organic matter in solution. This is easily understood when we remember that the so called springs of drinking water are generally uncovered, and permit the free entrance of leaves, of insects which adhere to them,[2] and of other organic matters and impurities carried by the winds, besides which, when the water in these ponds gets low it naturally becomes stagnant and corrupt. In many cases they are also, through ignorance or necessity, established near closets or dung heaps, thus adding the rapid and certain infiltration from these sources of corruption to the other causes of impurity already spoken of.

But the greatest evil, which on account of its peculiar situation has been caused by the water in Monterey and the worst for the health of its inhabitants,—an evil which experience pointed out many years before science could explain it,—is due to the natural inequalities of the soil, which have permitted the rain waters and the overflow from the streams and springs to accumulate in all parts of the city, and especially in those parts which slope to the south, west, and north, and which are at present in its very centre. Not so very long ago these waters were allowed to remain for long periods in those places until they disappeared by filtration and the heat of the sun; at present, with the improvements carried out, these waters are still allowed to stagnate, but only for a few days and in small quantities, although even that is still sufficient for the procreation and development of the different germs which inhabit the atmosphere and soil. In this manner I have found, in swamps formed by the rain-water of August of the present year, that a microscopic examination of these waters showed an extensive cryptogamic generation of naviculæ, diatomas synedrous, and many other spores and infusoria.

I do not see to what we can attribute the palustric endemic in Monterrey, unless it is to the evils sketched in the preceding lines. It is clear that all these form the links of one chain, and are closely allied between themselves. Neither the atmospheric variations nor the electric conditions, either of the atmosphere or the human body,[3] nor the gases produced by animal and vegetable decompositions,[4] nor the thermic oscillations—alone,[5] or united to an excessive humidity,[6]—nor the excess of fertility in the soil,[7] nor the emanations from any special

[1] See appendix, note 12, p. 207.
[2] See appendix, note 13, p. 208.
[3] See appendix, note 14, p. 208.
[4] See appendix, note 15, p. 208.
[5] See appendix, note 16, p. 208.
[6] See appendix, note 17, p. 208.
[7] See appendix, note 18, p. 208.

flora,[1] have I thought necessary to study as the cause of the epidemic in Monterey, which was certainly much more to be feared in former periods than at present. And if I did set aside all those supposed causes, it was because I am convinced that these supposed reasons for the infection are very often wanting where the infection exists, and are very often found unaccompanied by disease. Applying the principles above given, we find that the old formulas consecrated by time, such as that of the humid heat, and which are constantly cited in explanation of the infectious diseases, entirely disappear, and that their place is now taken up with a new doctrine, the biological doctrine of causes which was indistinctly perceived by Lancisi about two hundred years ago, and which has now been demonstrated as the true general principle, and practically applied by Pasteur.[2]

According to this new theory, the invisible and impalpable matter which was formerly supposed to cause disease of this kind, has been substituted by a real matter in the form of minute organisms, whose numbers more than make up for their small size and the apparent debility of the individual. According to this new theory the former exterior elements or means of infection have been reduced to the position of simple conditions, which may or may not be favorable to the development of one or another class of germs; though at the same time I do not by any means say that the study of these conditions has diminished in importance or that they are of no interest. On the contrary, I believe that the new doctrine, in consonance with the advancement and evolution of medical science, has increased this interest in proportion to the progress made.

Meanwhile it is still a disputed point, and not only with respect to palustric infection, as to what is the micro-organism that determines it,—whether it is the species of the genus palmella, which its discoverer calls gemmiasma,[3] or the bacteridium bruneum,[4] or the bacillus mallarice,[5] or the emoplasmodium,[6] or the hematozoaria of the learned Frenchman. This great scientist has many admirers as enthusiastic as Richard, for whom the presence of this micro-organism in persons infected with palustric fevers is a proved clinical fact that has never yet been disproved by observation. On the other hand, the great Frenchman has some opponents, such as Peter, who are worthy of every respect.

In Monterey[7] this hematozoarius was observed by Dr. Jesus M. Guerra in the year 1891, and by the speaker in the present year, after having received the most complete work as yet published in this country on the subject, that of Dr. A. Matienzo of Tampico.

But accepting without question the opinion of Richard, which would make of the protozoarius above mentioned a most useful element for

[1] See appendix, note 19, p. 208.
[2] See appendix, note 20, p. 208.
[3] See appendix, note 21, p. 208.
[4] See appendix, note 22, p. 208.
[5] See appendix, note 23, p. 208.
[6] See appendix, note 24, p. 209.
[7] See appendix, note 25, p. 209.

diagnosing doubtful cases, we have yet to clear up many obscure points in its history which are not convenient at present to enter into, as they would not be in accordance with the purpose of this memorandum and would be entering into the discussion of theories, which are certainly understood better by yourselves than by me. And, having now presented this brief and superficial study of the exterior department, in the hope, as I said before, that more competent heads than mine will be able to explain the cause of this disease, I beg to summarize in a few words the ideas with which I have written this paper.

Whatever may be the doctrine adopted with respect to the etiology of palustric poisoning, and whatever may be the micro-organism that according to that doctrine determines the disease, we can clearly deduce from the observed facts which I have shown in the above lines a practical and important lesson, which certainly is not new, but is very useful and worth remembering at every step, and that is, that the city of Monterey, with its special climate as above described, the peculiar constitution of its soil, and the special composition and quality of its waters, affords a special combination adapted to the development of this micro-organism; and if it is not possible to procure the entire extirpation of this germ, it is always possible to modify some of these conditions, as has been already done, diminishing thereby, to a great extent, the spread of the disease, at least as regards its frequency and its dangerous conditions. Another lesson that we learn is, that the most important factor in the palustric endemic of that locality is the water, though I do not mean to say that I consider it the exclusive cause. Experience certainly shows that, whenever at any time the waters were increased in the city, and their flow interrupted, causing stagnation, or when they flowed through infected water-courses, they would become corrupted and filled with decomposed organic matter, causing the endemic to change into a frightful epidemic of pernicious intermittent fevers, complicated with gastric and bilious fevers, and that whenever these waters were less abundant, the courses unobstructed, or when, as in these later years, the swamps were drained and the infected natural water-courses were substituted by masonry drains which were easy to clean, and the foul deposits of filth which were found in the centre of the city, were substituted by large and clean masonry bridges, the endemic diminished greatly and, to some extent, disappeared.

If, to the improvements already made, we add a better levelling of the soil in the suburbs, facilitating the drainage of the rain-waters, which even now sometimes stagnate, the improvement would be greater still. More trees ought to be planted on the banks of the streams and springs and in the unhealthy, damp soil, which formerly formed swamps, because, as is well known, trees purify the atmosphere, destroying the products of combustion, and the soil as well, by absorbing the matters required for their own nutrition and development, besides opening it up by means of roots and helping to drain off its humidity. If, on the other hand, care were taken to sink the wells of so called drinking water as far

as possible from the closets and dung heaps, if these were given a sufficient depth, and often cleaned besides keeping them covered, and if, as appears to me the best improvement, these wells were altogether suppressed by iron tubing, which to-day is only used in the public fountains, the terrible disease that we now speak of would be still further decreased, and a great advance would be made in the beneficial work of hygiene, that real science of the future, which, as we have seen, prevents with a sure hand terrible diseases, that, once established, are in many cases real rocks, against which the best reasoned science beats in vain.

APPENDIX.

1. Report by Dr. González Candamo, dated October 17, 1791, and addressed to the viceroy of Mexico, in order that he in his turn should report it to the Spanish court, and enable it to give orders as to the proper place for the Episcopal see. (José Eleuterio González, "Collection of documents and reports for the history of Nuevo Leon.")

2. For further details regarding the history of palustric epidemics in Monterey, and of some of the hygienic improvements carried out within the present century, see the statistics of the state of Nuevo Leon, published by Dr. José Eleuterio González in 1873, page 20.

3. The diagram shown was prepared by the present director of the González hospital, Dr. Anastasio Carrillo, and by the administrator of the same establishment, Eleuterio Espinosa, who have besides provided me with a room, apparatus, and their own valuable help in my investigations.

4. In the report presented by General Bernardo Reyes (1887), governor of the state of Nuevo Leon, we read in page 11 as follows: "Convinced by the opinions of the board of health, I initiated with the city council a proposition for the cleansing of the main drain which crosses this city, and the drainage of the swamps, a work which was called for by the public health." These improvements were carried out shortly after.

5. Work by Dr. González, already spoken of in note 2.

6. It is hardly necessary to say that in the text I followed the opinion of Laveran and Peissier, as given in their well known work on pathology. I do not constitute myself an absolute defender of their opinions or their special theories respecting palustric fevers, It is not my intention to discuss them, nor do I feel competent to do so, but I simply adopt their opinion because I find it favored by the majority of modern writers on the subject.

7. In an excavation which was made on the side of one of these hills, the chemical assistant of the Civil college, Ernesto Vidagaray, and myself found a vein of calcite and nickel very similar to garnierite. I think it necessary to state that these analyses were made rather in a hurry on account of the short time at my disposal, and I therefore only give them as approximate.

8. Some parts of this marl strata are completely uncovered, as for instance, in

the small square front of the González hospital and in the square of "La Lave," where the ground had to be opened up with explosives so as to make an excavation which could be filled with vegetable soil for the planting of a garden.

9. Alexander Humboldt (Kosmos), volume 4, pages 166 and following.

10. I have considered as the valley road, the place where the spring of water is found, and not the lower part through which passes the small stream that I refer to in the text.

11. Here I follow the division adopted by Hallman.

12. I do not believe that the quantitative analysis of the Monterey waters which accompanies the present paper is perfectly exact, because I was unable for want of time to repeat it as required for the purpose of taking an average. The organic matter I believe was more exactly measured, as that was necessary for the object and nature of this work.

For the determination of the amount of silica and other inorganic matters I followed the process advised by R. D. Silva (Professor in the Central School of Arts and Manufactures in the Universal School of Industrial Physics and Chemistry in Paris), in his work D'Analise Chimique. We worked as follows: To determine the silica we acidulated half a litre of water, which was analyzed, with chlorohydric acid; we evaporated this, till it was dry, in a platinum capsule which was weighed beforehand. We heated the residium to 130° C., and then allowed it to cool, and afterwards treated the contents of the capsule to separate the chlorohydric acid; the silica, which is insoluble in the acid, was recovered by filtration and weighed. To determine the amount of metals we evaporated the liquid filtered in the previous operation until it was reduced to 50 cubic centimetres, having previously added a few drops of nitric acid. We then treated it with chloride of ammonia, and heated it for a few minutes. We obtained a weak precipitate in some of the waters which we analyzed, and which was formed of what can properly be called metal.

In order to determine the amount of calcium contained in these waters we added oxalate of ammonia to the filtered liquid proceeding from the previous operation. The precipitate was separated by a new filtration, transformed into carbonate and weighed. For the magnesia, we concentrated the liquids which resulted from the precipitation of the oxalate, and treated it with phosphate of ammonia. The precipitate which we obtained was then calcined and weighed.

For the alkaline metals we added acetate of lead to the previous solution, which was then filtered and treated with sulphurated hydrogen, then filtered for a second time and evaporated till dried, then calcined, showing a mere trace of these metals.

For the determination of ammonia we adopted the reagent of Nessler, which, as is well known, is very sensitive, but which did not give any reaction in the waters that we examined. For the sulphuric acid we acidulated half a litre of water with chlorohydric acid and treated it with chloride of barium. It was allowed to repose for twenty-four hours, and then filtered to collect the sulphate. For the chlorine we precipitated the water previously acidulated with nitric acid by means of nitrate of silver. We allowed this to repose as in the previous case, and after washing and drying, we weighed the precipitate obtained.

To determine the organic matter we followed the process advised by Kaubel, which consists in finding out the amount of permanganate of potash which is de-

composed by the organic matter, which can be done by means of a solution of oxalic acid.

13. The well of the Civil College, whose water we analyzed, offers an example to illustrate the text. It is situated under the branches of a walnut tree, and in the month of July the water which we examined contained many leaves from this tree and a great number of insects of the order of lepidoptera.

14. This is the opinion of Folchi, Pietra Santa, and Santarelli.

15. Eissenmann and Arnaud.

16. Raymond Faure.

17. Minzi and Baron Mitchell.

18. Leon Collin. Dr. Guerra thus summarizes the opinion of Collin: "Palustric fevers are caused, above all, by the vegetating force of the soil when this is not brought into action, or when it is not exhausted by a sufficient number of plants. This is why in the swamps the vegetation appears to be enough to reduce its bad effects, and that is the reason why pools which are surrounded by spontaneous vegetation or covered with aquatic plants are much less dangerous than those which are wanting in active vegetation, unless its detritus is salt." (L. Collin. Traite des fievres intermitentes, page 14, Paris, 1870.)

It could be proved that there are many places with exuberant vegetation that are not exempt from malaria, that there are many others where we find no humidity, vegetation, or organic decomposition, but where we find palustric fevers; that if the presence of vegetation in the neighborhood of swamps renders them less dangerous it is not for the reason that it exhausts the productive force of the soil, but because it evidently diminishes its humidity, modifies its constitution, and prevents the dispersion of the malarial principles and the excess of heat and evaporation, etc. (See unpublished papers by Dr. Jesus N. Guerra, which exist in the archives of the School of Medicine in Monterey.)

19. Baudi, Ballestra, Eklund, and others, attribute the presence of palustric fevers to the emanations from a special flora, principally to those of the Antroxantum-oderatum, Limnophisalis hialina, etc. In the same manner, in the town of Gadereita Jimenez of the State, where the palustric fevers constitute a terrible endemic, they are attributed to the emanations of an herb which is very abundant in that locality, and which is vulgarly called "yerba del buey," giving a penetrating and disagreeable smell. I have not had an opportunity of studying its botanical character, but at first sight it appeared to me a euforbiacea of the croton genus. It is hardly necessary for me to say that this is only an empirical opinion and quite destitute of scientific foundation.

20. In the year 1717 Lancisi pronounced, in his "De nosciis paladeum effluviis," the theory that minute animals engendered fevers by penetrating into the blood.

21. According to Salisbury, the spores of gemmiasma are found on the surface of the ground, in the atmosphere of infected places, and in the expectoration of persons suffering from the disease.

22. B. Bruneum de Lanzi y Ferrigi. It would present itself under the form of zoöglœæ on cultivating the inoculated elements of the liver and spleen of animals, which have been subjected to an injection with the blood of persons attacked with paludism.

23. B. Mallarie de Klebs y A. F. Crudelli. It would present itself under the

form of an elongated thread spore with an oval shape, with a maximum length of seventy-five millimetres, when found in the soil of palustric localities, and under the form of segmentary filaments with a great number of sporule germs, when found in cultivated lands.

24. The hemoplasmodium of Marchiafava y Celli of a round form with pigmentary granulations provided with rapid movements. They unite with the red corpuscles of the blood and present amiboidal movements.

25. We have been unable in Monterey to observe the "flajelos," perhaps because we could not obtain a microscope which would magnify more than 850 diameters. In the careful study made by Dr. Jesus M. Guerra of Monterey, on palustric infections, he says that he could not observe them with any certainty. Dr. Matienza, who, as I have said, has written the best work on the subject which I have seen in our country, says that he has only seen them a few times.

XXXI.

PHTHISIS IN GUADALAJARA, MEXICO.

By DR. J. M. BENITEZ,

Guadalajara, Mexico.

It is no longer discussed, since the discoveries of Koch, whether tuberculosis is or is not a specific disease, and whether its bacteria are subject, in birth, development, and manifestation, to the physical laws to which the other organisms of the class are subject—that is, to altitude, nature, dryness of the soil on which they are born, hygrometrical condition of the air, etc. The result of these considerations is, that as the bacillus is a cosmopolitan it exerts its influence with more intensity in this or that city, town, or village, as it finds in them the necessary conditions for its full development and multiplication, wherever these conditions are to be found,—in the locality itself, or in the individual, subject as that may be to bad hygienic conditions, either general or individual, which bring to a certain number of their inhabitants weakness and exhaustion of their systems. This organic weakness in itself constitutes the aptitude or predisposition to foster the birth, development, or any other manifestations of the agent of tuberculosis. As this agent is found scattered about—in the water, air, milk, etc., and in man himself, latent or inactive in his mouth, larynx, bronchus, etc., without injuring them, unless there is through special circumstances (which it would be very difficult to exactly define), a certain degree of malignity or virulence, or unless the subject who has them is placed under suitable circumstances to be attacked by them,—it can be deduced that for the development of tuberculosis, two conditions are necessary: first, the activity or virulence of the bacteria; and second, the organic weakness of the subject on which the agent is placed—that is, the favorable disposition of the field in which it is to germinate. The concurrence of such conditions is generally the cause of the disease; therefore those towns which enjoy the best hygienic conditions are the most likely to avoid the development of tuberculosis and are the best for its cure when it has been contracted. It seems to have been proved—by Jourdanet for Mexico, Guilbert for Bolivia, Toner for the United States, Antoine Abbadie for Africa, and Müller and Eichhorst for Switzerland—that above five hundred metres the frequency of phthisis is in an inverted ratio to the height over the level of the sea, and to such a degree that Jourdanet considers the disease as exceptional at 2,000 metres of altitude; and it seems to me that this goes to prove that the virulence of the bacteria of Koch lessens considerably with the height of the

locality, and that if phthisis is less common in elevated regions it is due rather to the diminution or want of activity of said agent, than to the greater resistance of the individuals to contracting the disease; as in general, the weakness of the system is in a direct ratio with the height of the locality in which they live; and furthermore, as I understand it, the anoxyhemia of Doctor Jourdanet is rather a cause of predisposition than of immunity.

The city of Guadalajara at 1,567 metres above the level of the sea, according to Professor Lázaro Pérez, possesses other hygienic conditions that are really peculiar to her, on account of her topographical situation, nature of the soil, arrangement of the buildings, number of inhabitants, purity of the waters, etc., and is a city not only convenient for avoiding the development of phthisis and for its cure in case of suffering from it, but is also highly favored in general from the sanitary stand-point, as is proved by the fact that the cases in that city, not only of phthisis, but of typhus, typhoidal, and some other infectious diseases, are exceedingly rare.

According to Narvaez, Guadalajara is situated at 20° 41′, north latitude, and 4° 13′, longitude west of the meridian of Mexico. According to the engineer, Mariano Bárcena, the maximum of temperature of the city is 34.5°; minimum, 1°; yearly average, 19.3°; annual medium humidity, 72; medium annual barometric pressure, 766–4. It is to be observed that the oscillations of temperature do not cause, in general, serious sickness, but only slight colds that may tend to complications in case of neglect, and even in tuberculosis subjects, when they are properly attended to, those changes exert no influence in the course of their disease.

The western winds predominate, and in the months of June, July, August, and September, the wind blows from the east, and is cool and agreeable. In April, May, and a part of June, during the day-time no wind seems to predominate, but at twilight and in the night, fresh western breezes blow, diminishing the heat and making the climate delicious. From the middle of October to February, northers are not scarce, but are very seldom impetuous.

The city, with a clear and beautiful sky, lies on a wide and open valley, on a sandy and dry soil, surrounded by low mountains at some distance from the town, and sheltered by them from the winds. Towards the north, and from one and a half to two leagues from the city, the valley is cut through by the gulley of the river Cuitzeo or Tololotlan, a most lovely place, where several thermal springs are to be found. Of the mountains, the most striking one is the Colli, of an elongated shape, like a ridge, extending from south to north on the west, and serving as a wall to moderate the impetuosity of the winds blowing from that quarter, and that for some hours of the day are troublesome in the months of February and March. Winter, that lasts at most three months, is far from being uncomfortable on mornings and evenings, as the light northern winds generally leave off blowing for many days at a time, when the

fogs and light rains, so common in that season, give way to a clear sunshine and the enjoyment of spring-like nights. The long summer is generally agreeable, and it can be stated that heat is only felt from the second fortnight in April to the first one in June, when the rains cool the atmosphere and the soil, and during the hottest days the mornings and evenings are cool, as the western breeze very seldom dies out. The streets of the city are straight and at right angles, with a slight but sufficient declivity to prevent the water when it rains from standing in pools; this, and the porosity of the soil, are the reasons that, even after the heaviest showers, which are so frequent in the rainy season, the streets are perfectly dry a few minutes after it leaves off raining.

The streets are carefully cleansed. Their width is in proportion with the height of the buildings, that on account of the frequency of earthquakes and instability of the soil are, as an exception, of three stories, many being of two and the majority of only one. All the dwellings are perfectly dry, well ventilated, and spacious, with more or less large courtyards, and a garden in the centre of them. According to the observations of the engineer, Lucio Gutierrez, the area of the city embraces 725 hectares, without including the unbuilt portions, that lie mostly near the city gates and measure 1,200 hectares. The inhabited portion is laid out in 763 blocks, that have 7,455 dwelling-houses, without including in this number the public buildings. Of the dwellings it may be calculated that about 1,000 are two stories high, including in these the few three-story ones.

Official reports state Guadalajara's population to be between 65,000 and 70,000 inhabitants, and this calculation would give to each house only eight dwellers—an important item worthy to be taken into consideration, as showing that in Guadalajara the danger inherent to agglomeration is not to be feared. The main public establishments, in which agglomeration cannot be avoided, such as the house of charity, penitentiary, hospital, etc., add to their enviable magnificence in their general details, as well as in each of their departments, those dispositions in accordance with the most important hygiene rules. The lyceums and other establishments of public instruction and beneficence are likewise perfect on that score. To these favorable conditions, in which, as stated, the public establishments are found, must be added the fact that there are in the city several squares and gardens, an extensive park, and beautiful resorts, all well frequented and where the scent of the flowers and the essence of the cedars can be breathed.

The drinking waters are very pure, with the exception of the small amount that is at present taken from "Agua Azul;" that is roily and full of organic matter. The water in common use is from filtrations that belong to the Colli mountain and that come through a natural filter composed of "Pomicce Tophus," that forms the basement of the valley. The surrounding country is dry and arid in summer and with but few trees, but in the rainy season, that begins in the middle of June and ends in the first days of October, the surroundings are naturally picturesque.

The rivulet that divides the city in two portions, thanks to the work lately undertaken on it, is clear of all filthiness and very soon will be in splendid hygienic condition. The articles of food used are varied, healthy, and abundant. These remarks which I have just made as a rough sketch, can be found fully detailed in an interesting article by Doctor Pablo Gutierrez, published in the first volume, page 413, of the "Gaceta Médica de México," which may be profitably consulted. If I were to enter into further details on the subject, I would lose sight of the object that I propose—that is, to show that the city of Guadalajara, according to my judgment, is singularly fitted to avoid the development of tuberculosis and affords to those suffering from it a convenient residence, that is not only agreeable, but is also a place where their suffering may be diminished, their lives lengthened, and where even they may be entirely relieved.

To prove this assertion it is enough, for my purpose, to consider the inhabitants of Guadalajara divided into three classes: the highest, the medium, and the lowest or poor. In the first class, I have no hesitation in asserting that during a practice of 23 to 24 years, somewhat steady, I have not seen one patient of pulmonary phthisis, nor have I heard of there being one case in that class of society. Among the middle class, where my practice has been more extensive, I have observed five cases in persons belonging to this city; of these, three belonged to the same family and had inherited the disease; the other two probably had acquired it. In persons not of Guadalajara, I have observed four cases, two of them young persons that came from two cities on the shores of the Pacific, and who recovered in this city in one or two years. The first of the cases that I observed in the years 1880–'82 returned to his native city, Tepic, where he lives healthy and vigorous. The second one has not acquired the strength of the former one; he is a native of the port of Guaymas, and lives, up to date, in a mining town near that city. Both those patients had acquired the tuberculosis. Among the lower or poorer classes, phthisis is less rare. In my gratuitous consultations in the period of years I have referred to, I have only been able to observe two cases, but it must be remembered that this kind of patients generally goes to the hospitals. In the private hospital for women, of the "Sagrado Corazón de Jesus," and of which I am in charge, since its foundation in February, 1887, the number of patients under treatment have been 1,680, and of these, only three were cases of pulmonary phthisis, one of the patients being a native of Mazatlan, and the other two of this city.

By what I have stated, it is to be inferred that in Guadalajara pulmonary tuberculosis is very rare or exceptional among the higher classes, rare in the medium, and not very common among the poor; that is to say, that persons that have good or fair food, that dress in a convenient manner, dwell in dry and ventilated houses, and possess a certain degree of culture to profit by the most indispensable hygienic means, are generally exempt from phthisis; remarking at the same time,

that even among the poorer class that are destitute of all or many of these means, that disease is less common than in other cities of the western portion of the country, according to the information that I have been able to collect. As to scrofula, it seems to me that in Guadalajara it is a rare disease, though in a less degree than pulmonary phthisis. Cases of cold abscess and lupus do not seem to me to be scarce, and I even dare to state that they are common among the poor classes, on account of their uncleanliness, united to the predisposition in which they are placed, owing to their physiological misery.

In conclusion, I believe that Guadalajara is a very suitable city for the cure of phthisis, as within her limits she unites the greater number of circumstances that are necessary for the beneficial residence of that class of patients.

XXXII.

THE CITY OF TUXPAN.

By Dr. E. ALCÁZAR,

Tuxpan, Mex.

The city of Tuxpan is situated on the left bank of the river that bears the same name, and is three leagues from the shores of the sea.

Its climate is hot, like that of all places on the gulf. From the information I have gathered, the rains are plentiful, but this year it has not been so, the number of times it has rained having been counted and not exceeding twelve, and this is noticeable in the dryness of some of the wells from which the inhabitants are supplied with drinking-water, while in others the level of the water is much lower than usual, all of which may have something to do with the cases of yellow-fever that have broken out in the town.

This disease is not endemic, and since the year 1865, when there was an epidemic, according to the inhabitants it has not presented itself until now, being imported by a traveller from Papantla, who arrived ill and succumbed to it on the 10th of August last, three days after his arrival. Having made inquiries, as to whether there were frequent arrivals from other places, of patients suffering from yellow-fever, I found this to be a fact, but the disease does not spread in this town. I could not obtain reliable information as to whether there was the same dryness in 1865, the year of the epidemic, as there is now.

In my opinion, from the facts presented to my notice, yellow-fever can show itself spontaneously. It is true that the first case here was that of the traveller from Papantla, but his clothes and all articles used for him were destroyed, and the room occupied by him in the hotel disinfected.

On the 6th of September, a patient was sent to me at the hospital already in the second stage of the illness, and he expired the next day. The house of this individual was in a locality apart from the city, and inquiries were made whether he could have come in contact with the first patient, but it was proved that he had not. On Wednesday, the 7th, there was another case in the prison, where there are one hundred and forty to one hundred and sixty persons in four rooms of about seven or eight square yards, with little light and very impure air, for the water-closets are in the same rooms. I proceeded at once to disinfect, not only the rooms, but the clothes of the prisoners. I must mention that the water used was from a well, whose level was very low, and the taste of

the water salt. I prohibited its use. Until now no other case has presented itself in the establishment.

The judge of the primary court of claims, Licentiate F. Morales, at the moment of writing is taken ill with yellow-fever. He made his visit to the prisoners on Saturday, the 10th.

The water he uses is from a well in another house, for his own is is nearly dry.

The other three cases registered are of individuals from different districts. Of the cases mentioned, one belongs to Dr. Emigdio Garmendia and another to Dr. Juvencio Medina.

These are the particulars I possess of the illness in the town, for, I repeat, it is not endemic, and inferences would be of no value, on account of the few cases there. Notwithstanding, it is necessary to notice the coincidence of the appearance of yellow-fever with the dryness of the season, and the use of infected water, the case in the prison whose inhabitants were using this water, and no other case having appeared after the disinfection and destruction of the clothes.

This is all that can be said of yellow-fever in this locality, and to affirm with certainty that it can appear spontaneously, the study of several years would be necessary.

The city of Tuxpan has several streets crossed by small creeks, which fill with water in the rainy season and are dry at other times, the grass growing in them with wonderful rapidity. The burning action of the sun produces the fermentations necessary for the growth of paludic miasma, and it is noticeable that it is at the epoch when effervescence takes place.

The commonest forms are remittent and intermittent, beginning with gastro-intestinal symptoms and yielding to the action of quinine.

At the present time a fever has been noticed that follows the same cycle as typhoid during seven, fourteen, and twenty-one days, without yielding to the action of the antiperiodics. The temperature is from 38.5° to 39° in the morning and from 39° to 40° at night, but patients have not the same alarming appearance as those suffering from typhoid, nor have they any hemorrhage, petechiæ, or other symptoms of typhus or typhoid fever.

As to whether this form is common in the locality, the doctors who have practised here, one of them for three years, assured me that they have observed it before. In this form the hepatic gland is hypertrophied much more than the spleen, the gastro-intestinal state being well marked.

These notes that I have the honor of presenting have no pretensions to a study, they are merely a relation of the little I have become acquainted with during my short stay in that port.

XXXIII.

A FEW GENERAL REMARKS REGARDING YELLOW-FEVER IN THE STATE OF TABASCO.

By Dr. A. CASTAÑARES,

Tacubaya, Mex.

In consequence of my prolonged residence, during twenty-three years in the state of Tabasco, dedicated to the practice of medicine, and owing to the special circumstance of having held the position of head physician to the only civil and military hospital in San Juan Bautista, capital of the state, I am in a position to be able to refute certain erroneous beliefs, unfortunately too generally disseminated, and to propound certain facts which may be of general utility, but without in the least pretending to speak of anything new or of what the greater portion of you are not already acquainted with.

The state of Tabasco is situated in the torrid zone, on the seaboard of the Mexican gulf; it is limited on the north by said gulf, on the east by the state of Campeche, on the south-east by the republic of Guatemala, on the south by the state of Chiapas, and on the west by the state of Veracruz; its territory lies between 16° 50′ and 18° 39′, north latitude, and between 5° 11′ and 8° 10′ longitude east of the meridian of Mexico.

As Tabasco is surrounded by districts where yellow-fever prevails in an endemic form, and as, owing to its geographical position as well as to its atmospheric and telluric conditions, it is similar to these districts, it would be supposed (and such is really the general belief) that the black-vomit exists in Tabasco in an endemic form, the same as it does in Veracruz, Tampico, Campeche, and Yucatan.

Nothing, however, is more erroneous than this belief, gentlemen, because, during the twenty-three years of my sojourn in the state, I had had occasion to observe only three epidemics of the disease, and that notwithstanding the pertinent fact that Tabasco is in frequent contact with the above mentioned zones where yellow-fever prevails, because hardly a week passes during the entire year in which some vessel, coming from Veracruz, Tampico, Campeche, Yucatan, and even Havana, does not arrive at the port of Frontera and at the capital of the state.

The soil of Tabasco is so unpropitious to the generation of the yellow-fever, that the constant arrival of travellers, as before mentioned, is not sufficient to spread and develop it; very potent and influential causes or powerful centres of infection are required, such as the arrival of an army corps,—which, as is well known, almost always travels under the worst

possible sanitary conditions,—and it would be necessary that such a corps should have come from a place where at the time of departure the black-vomit prevailed. It has furthermore been noticed that for the germ to be effective the importation of the same must take place in summer or autumn, and that notwithstanding the presence of all conditions favorable to the development of an epidemic, the latter has not extended beyond the limits of the infected district, but has remained in such locality without spreading to the other parts of the state, although no precautionary measures of isolation, or other steps, may have been taken to avoid it. Only in case the primitive, productive cause of the disease passes from one part of the state to another,—only in this case, I repeat, have we had to deplore its propagation, causing the same characteristics as in the locality where it originated.

The period of incubation cannot very well be accurately defined, it being quite variable, but running generally in proportion to the intensity of the epidemic. The appearance of the disease is preceded by an indescribable though painful restlessness, lasting four or six hours without the prevalence of any characteristic symptoms. In such cases the disease breaks out and develops in a sudden manner, which frequently ends fatally.

The mere fact of traversing an infected locality has often been sufficient for one or more of the passers-by being violently attacked by the disease.

I dare say from my personal observations that as a rule three days is the longest period of incubation which has come under my notice.

I have nothing to tell you with regard to the symptoms, anatomy, pathology, and diagnosis of this disease, which has not already been set forth in the numerous treatises published on this subject, but I wish to refer to a few peculiarities respecting the place of birth of the attacked persons.

Among the Mexicans born in the cold country, the natives of the neighboring state of Chiapas, are, with astounding preference, the first victims; it is demonstrated that through them the germ of the yellow-fever invades a district, jumps from one place to another far distant one, penetrates house after house, pursues the natives of San Christobal or Comitan, smites them unto death, and when it has concluded with them spreads itself among the inhabitants. The preference of the disease seem then to be to attack the Mexicans located on the heights, and last of all the foreigners.

The natives of the state, those born in Tabasco, are not subject to the disease, unless the following two causes should prevail: severity of the epidemic—in a number of cases the same as the mortality—and the total absence of private hygiene; I had the opportunity of noticing this during the terrible epidemics of 1876 and 1882, the last which I saw, when many persons died who led a licentious life, entirely given to intoxication and venery.

The different idiosyncrasies which I have mentioned are problems

as interesting as they are obscure, which up to date have not been explained. Why should the native from Chiapas be predestined to certain, and almost always mortal, attack? Why should the Mexican from the heights, although in a lesser degree, be attacked, and whence arises the immunity of the natives of Tabasco, and more especially those of Veracruz and Campeche? Perhaps the suddenness with which a native of Chiapas goes from a very cold and very elevated locality to Tabasco, situated on the sea level and being very hot, may, among many others, be one of the contributing factors to such a mournful predestination.

However certain, although inexplicable, the foregoing facts are, as regards the greater or lesser facility with which recent arrivals in Tabasco, or those who have been there a few months, contract the disease in time of an epidemic, there are other circumstances in this same connection worthy of note. A native of Tabasco can with immunity go to Veracruz or Havana at a time when the black-vomit may be raging with great violence. The same, gentlemen, will happen to natives of Chiapas and other Mexicans from the heights, as well as foreigners, after a residence of two or more years in Tabasco, although the disease may not have appeared in an epidemic form during that period; some persons need still less time to acquire such immunity, if, on their arrival at Tabasco or during their sojourn there, they are laid up with a slight fever, called acclimatization fever, or with any other fever of a paludic character which is endemic in that locality.

In the three epidemics which I passed through, I especially noticed that the diminishing of the urine and its subsequent stoppage for one day was a sure prognostic of death. In this latter case, all the measures recommended by science against anuria were resorted to in vain; the secretion of the urine was not re-established, and the patient, after four or five days' illness, still full of vigor, without fever, or lumbar pain, or nausea, or vomiting, without any other symptom to foretell the danger of a near death, would suddenly be seized with convulsions and delirium, followed by mortal collapse, very probably caused by uremia.

The preventive steps adopted must attain two ends: First, prevent the appearance and spread of the disease; second, impede the contagion and development of same. To obtain the first end, it is necessary to exercise exceeding cleanliness in the streets and habitations, keeping the localities destined to the loading and unloading of vessels as far as possible from the cities in seaports, and a strict quarantine of from twelve to fourteen days against all vessels coming from infected places, and fumigating the vessels, crews, and merchandise. To attain the second, the enforcement of all such sanitary measures and personal care as are applicable to all infectious diseases.

With regard to treatment, my experience does not warrant my recommending any of the remedies now in use; perhaps evacuants, alternately administered with chlorate of potash in heavy doses, is one of the curative methods from which the greater results have been obtained.

It is, however, my profound conviction that to public and private hygiene, and not to therapeutics, is reserved the future decisive triumph over yellow-fever, and in general over all contagious and infectious diseases.

So as not to deviate from the subject of this treatise, nor to go beyond the limits laid down by the regulations of this Association, I will, in conclusion, restrict myself to informing you that the privileged soil of Tabasco, possibly the most fertile in the whole extent of our country, and even in the world, is without any doubt the healthiest of all the places situated on the Gulf and Pacific seaboard and forming part of the Mexican Republic.

XXXIV.

A CASE OF YELLOW-FEVER, OBSERVED IN THE CITY OF PUEBLA, DURING THE MONTH OF NOVEMBER, 1892.

By Dr. ANGEL CONTRERAS,

Delegate from the State of Puebla.

Gentlemen: The importance of clearing up the very scientific points which are connected with the development of yellow-fever outside of its ordinary zone on the coast, where it is found in an endemic form, has induced me to occupy the attention of this illustrious Association with the report of a case which I have observed in the city of Puebla, during the middle of November of the present year, and a few considerations on the case.

I perfectly understand how little is to be deduced from a solitary case in matters of this kind, but my intention is to coöperate by all means within my reach in the solution of a problem, which, like the one under consideration, is not as yet placed on a scientific basis.

The questions to be considered are as follows:

Do those who contract the black-vomit on the coast aggravate the disease by moving to a more elevated situation, in which to pass through the stages of the disease?

How far outside of the zone in which yellow-fever prevails in an endemic and sometimes epidemic form, is this disease not transmissible to other individuals, rendering thereby the prophylactic precautions unnecessary?

What is the differential diagnostic between black-vomit, typhus, and incipient typhoid fever of a bilious form, with certain palustric fevers, and other hepatic diseases, such as aggravated jaundice?

In what season or months of the year, or under what circumstances, can persons travel on our coasts without danger?

And lastly, What is the best prophylactic and curative treatment of this disease?

In my opinion, all these points demand the careful study and publication of all the cases which physicians meet in their practice, especially considering the very grave character of this disease which is the scourge of our coasts and a great impediment in the way of its commercial and industrial relations.

I will now relate the history of my case:

Conrado Gamboa, a native of Morelia in the state of Michoacan, a resident of Puebla, thirty-five years of age, of a normal constitution, of good previous health, never having

suffered from typhus or other notable disease, went to the gulf coast of Mexico for the first time, in the beginning of November of the present year; he was in Veracruz, afterwards in Alvarado, then in Tuxtla, and in Alonzo Lázaro; in which last town he felt a chill and had a little cough. For this reason he gave himself a hot foot-bath and returned through the same points; on Sunday, the 13th, he remained in Veracruz, where he had arrived on Saturday evening; he relates that he was on the beach for some time, collecting shells; on the day following he left Veracruz by train, arriving in Puebla at 8 o'clock the same evening. During the journey he felt a disagreable effect from the wind which entered the car through one of the windows, so that when he got home to his family he was hoarse, complaining of cough, of pain in the chest, and general weariness, for which reason he took a hot foot-bath; on Tuesday, he changed his underclothing and rose from his bed to attend to his business, but as he could not get over the tired feeling that he had, and felt feverish, he remained in bed. On Wednesday, the 16th, I saw him at 10 p. m., at his house in Callejon de Santa Catarina, No. 9. He had all the normal symptoms of fever, but without cephalalgia nor raquialgia. He had suffered epistaxis, had a temperature of 39.9°, pulse at one hundred and twenty, a slight cough, pain in the chest, no symptoms visible of pulmonary or cardiac suffering, the tongue very much coated, complained of constipation, etc. The family were very anxious to know what disease the patient suffered from, and I informed them that he was threatened with fever, perhaps typhus, but that the disease would declare itself later on.

Prescription: Sulphate of soda, 30 grammes in a 1: 20 of sweetened water to be taken at one draught. Volatile liniment with laudanum, to be rubbed on the chest. Food moderate and the patient to remain in bed.

Thursday, 17th: At 11 a. m. the temperature was 39.6°, pulse 116, the patient suffering from insomnia, general relaxation, ocular-palpebral injection, the tongue white; the purge produced several stools; the patient had suffered the previous evening from nausea and vomiting, no sinking on the intestines. There was no exanthema nor petechiæ, the liver was of a normal size, the spleen slightly increased, there had been a little epistaxis, a slight cephalalgia, the urine was scarce and high-colored, etc.

Prescription: Extract of quinine 0.60 grammes in six pills, to be taken during the morning. Antipyrine, 1.50 grammes in 1:50 of sweetened water, to be taken in two draughts, one in the afternoon and the other at night. For drink, sweetened water with the juice of a lemon.

Friday, 18th: At 9 a. m. the temperature was 38° and the pulse 90°, the skin yellowish with a jaundiced appearance, no adynamia, no exanthema, no petechiæ, bilious and tenacious vomiting since taking the antipyrine on the previous afternoon, for which reason he had not taken the dose prescribed for the night; the evacuations, which I had not been able to see, were watery, the urine scarce and containing albumen.

Diagnosis: yellow-fever. Prognosis: dangerous. A consultation was agreed upon with other physicians.

Prescription: Extract of quinine 0.60 grammes in six pills. Riviere's anti-emetic potion in spoonfuls, Nos. 1 and 2, with frequent eating of ice. Milk.

Consultation held at 6 p. m. with Drs. Estevan Lamadrid and Daniel Guzman. We observed that the vomits and the excreta already presented some black clots, appearing something like flies' wings, that the temperature was 37.7° and the pulse 80. My esteemed companions ratified the other symptoms and confirmed the diagnostic.

We agreed to continue the use of quinine under the form of a fluid extract, and prescribed injections of dilute carbolic acid.

November 19th, 9 a. m. My esteemed friend and colleague, Dr. José Maria Marin, accompanied me to visit the patient. His face showed evident signs of an advanced jaundice, he suffered from hiccough, abundant epistaxis, an exaggerated adynamia, melanical vomit and stools, anuria, temperature 37.8° and pulse 68°. His mind was perfectly clear.

We prescribed castor-oil with lemon-juice, in spoonfuls, and continued the injections with a solution of carbolic acid in thousands. In order to allay the hiccough we recommended the drinking of water with vinegar.

At 4 p. m. the patient died.

CONCLUSIONS.

It cannot be doubted that the patient to whom I have referred suffered from yellow-fever, for the following reasons: First, the locality where he contracted the disease, for although it is not possible to state exactly where he acquired it, nevertheless we know that the disease is endemic in all the places which he visited, and that it is sometimes epidemic. Second, the symptoms, progress, and termination of the disease were those which characterize yellow-fever and which are not found in any other; because, even if at the beginning typhus was to be feared rather than diagnosed, nevertheless, from the third day in which the reactionary period passed and the disease was localized, it was characterized by the lowering of temperature, by jaundice, by sanguinary vomit and excreta, by albuminuria, etc., and there could be no doubt that we had to deal with a case of yellow-fever. Third, this diagnosis was accepted by Dr. Lamadrid, who has been practising our profession for 51 years, and who informs me that he has already observed several cases of black-vomit in Puebla, principally in former times, when merchandise was brought into the interior by wagons, and when the teamsters were exposed to all kinds of weather on the journey and committed all kinds of hygienic errors in the way of living. These people often presented cases of the disease on their arrival in Puebla.

Drs. José M. Marin and Daniel Guzman, who have at times practised on the coast and who have seen many cases of yellow-fever, also agreed completely with the diagnosis.

The bacterioscopic examination was wanting, which would very likely have discovered the cryptococcus exanthogenicus of Freire or the alga of Dr. Carmona; but I have not the plant or instruments necessary for bacteriological investigations.

The treatment employed was principally purgative, having first prescribed the sulphate of soda and afterwards castor-oil; during the whole course of the disease drinks were used which were acidulated with the juice of lemon, quinine was used as a tonic, aerated waters and ice were employed with the object of restraining vomiting, and injections of diluted carbolic acid were employed, which were expelled as soon as applied, the patient thus absorbing very little of the acid. At the same time these injections had the advantage of carrying out the antisepsia of the lower extremity of the intestine, giving rise to the microbicidal action of the acid that might enter into the circulation, as we remembered a case that was communicated to this Association by our friend and companion, Mendizabal, in which he obtained good results with a patient suffering from yellow-fever by means of sub-cutaneous injections of this acid; but we used this agent with the greatest precaution, as we feared the collapse and lowering of the temperature that might supervene at that period of the disease in which these phenomena are so much to be feared.

In the five years that I have been practising in Puebla, this is the first time that I have seen a case of the disease here treated of, and in 17

years, during which I practised in Pachuca, I only saw one such case in company with Dr. Talavera, the patient being an Englishman, who had just arrived from Veracruz.

I know that Dr. Gustavo O'Farrill attended a man in Puebla, who was attacked by this disease when passing through Veracruz, three or four months ago.

All the cases of yellow-fever that I have heard of as being attended by my companions in Puebla, occurred in persons coming from Veracruz. They have always terminated fatally, and in no case have the persons who have come in contact with the patients, or with the objects which they used, suffered from the contagion.

I conclude, hoping that among some of the illustrious members of this Association will be found physicians with sufficient experience of this special disease to solve all doubts on a problem that is so important to public health.

XXXV.

STREETS AND SQUARES IN TOWNS.

By ANSELMO CAMACHO, C. E.,

Toluca, Mex.

Invited by the government of the state of Mexico to take part in the meeting of the American Public Sanitary Association, in the city of Mexico, my first intention was to excuse myself, as my impaired sight prevents me working, and because my thoughts concerning the subject of my essay are alike too superficial and incomplete, and therefore devoid of merit; but on the other hand, the benevolence of the government, and my having initiated some ideas about streets and squares to the honorable corporation of Toluca, compelled me to write this essay.

I will, therefore, state the arguments that I have adduced, because, as the ideas that have been accepted might lead to committing important errors, I have wished, as in duty bound and laying aside all that concerns my humble personality, to search above all for truth and success, and by means of timely reforms avoid the disastrous consequences of mistakes in public sanitation, which is so important for the improvement of our country.

By what I have stated it may be easily surmised that in presenting this essay my object has been to state my doubts, and not to lay out precepts that I do not consider myself competent to establish.

Let this frank avowal be an apology for my errors, or at least an extenuating circumstance, so that I may be pardoned for my daring.

Towns require interior thoroughfares, which are the streets, and centres of reunion, such as gardens, squares, and markets.

I will mainly examine what concerns streets and squares.

STREETS.

Streets should be rectilinear. It is a well known fact that in canals, so that the velocity of the liquid shall be steady, the direction of its axis must likewise be so, as also the uniformity of its declivity and section. Undoubtedly a street, considered as a unit, represents a canal through which the air runs, dragging in its course the miasmas that there may be, and therefore this current should meet with no obstacles that may modify it, weakening its efficacious action. Furthermore the rectilineal direction makes easier the distribution of conduits and sewers, and affords to the

police a better means to watch for the security of the neighbors, imparting them protection, than in streets that are winding or curved.[1]

The orientation given to streets is determined by several causes. Where two streets cross each other their axes form angles, the bisectors of which correspond with the direction of the dominant winds. The salient dihedron made by a corner on receiving a current makes it lose a part of its velocity, as its efforts are decomposed into two others that follow the direction of the streets. If the wind has a direction parallel with the street, it carries through it all the impetus of its current, and becomes troublesome to the wayfarer; when it has a velocity of 9 metres it interrupts the functions of the respiratory apparatus. If the direction of the wind is perpendicular to that of the streets, with a velocity of seven or more metres, the current is no longer so efficacious. The dominant winds in Toluca and a great part of the valley, blow from the north-east and south-east, so that the best orientation of streets is from north to south, and from east to west.

As streets bound buildings, and these should receive the sun's heat and light, the most convenient orientation is the one referred to, as it will be proved afterwards.

In my opinion the width of streets should be governed by the following circumstances:

The sun's heat and light.—The inhabitants of Toluca, and generally those of all the valley, have a weak constitution, and are of a lymphatic-nervous temperament.[2]

This proves that dwellings should be exposed for the longest time possible to the action of the sun's heat and light, but in such a way that transitions from heat to cold shall be gradual.

Toluca is 19° 17′, north latitude, and during the winter solstice, when the winter is more severe, the sun has a southern declination of 23° 20′; when the sun is in the meridian, the angle of his rays with the perpendicular is of 42° 45′.

In such conditions the meridian shade of a building, measured from its foot, is,—meridian shade=height × tang (42° 45′)=height × 0.942.

This shade, which is the minimum, is about equal to the height of the building.

By what has been stated it can be easily understood why the streets that run east and west should have a greater minimum width than the height of the buildings. With such an excess in their width, on receiving the sun they become calorific foci that mitigate cold in the shadowy zone. It must be borne in mind that when the thermometer shows the minimum temperature of —2°, ice does not melt till about 12 o'clock, and that the water sprinkled on the streets immediately freezes as late as 9 a. m. The enormous height of the valley over the sea level (2,540

[1] In Toluca, as in other towns, there are many winding streets and very narrow alleys (of 3.50 to 4 metres) some of which have been closed up. The declivity of the ground south of the river is nearly uniform, running from south-west to north-east, and the medium average is about 1 per cent.

[2] Dres. J. Rodriguez and M. Camacho.

metres at Lerma) causes consequently a very powerful calorific radiation, and if to this we add that the winds that blow are cold (north-east in the evenings and south-west at night), we have a clear explanation for so great a coolness.

The length of the greatest daily heat is from 9 a. m. to 3 p. m., according to the register of the observatory of the institute. If we imagine a street running south to north, the buildings fronting east will receive the sun from the foot of their wall at 8 a. m., and will require a shade equal to the shadow—that is, shade=height × 1.86; from this result and the former one, we can deduce a useful medium term

$$\text{width} = \frac{3}{2} \times \text{height}.$$

Most all houses in our country are of one and two stories. The height of each floor can be calculated in 5 metres; if they should be higher the rooms would be very cold, and consequently unhealthy. According to this a two-story house would be 10 metres high. It would not be prudent to build them higher, because the currents of air would not clean out the court-yards, and as earthquakes are of frequent occurrence, very high buildings not built in accordance with special rules, would be exposed to irregular vibrations and considerable damage. If therefore a height of 10 metres is adopted for buildings, the width of the streets should be of 15 metres, but we must bear in mind that, the zone heated by the sun in this case being very narrow, the value assigned must be taken as an irreducible minimum, and, therefore, fixing 15 metres for the paved streets, and for each side-walk 2 metres, we will have a normal width of 19 metres.

In many towns, as in Toluca, trees are planted in the streets to embellish them, affording shade and increasing hygiene.

Let us examine this proceeding. If the tree is too near the house front it prevents free ventilation, and the shade likewise prevents evaporation taking place from the walls, diminishing the permeability of the wind, as has been shown, and even exaggerated by Petenkorfer and acknowledged by Hudelo.

Furthermore, the roots will injure the foundations—more so, if they are strong; they may even hurt the building. On this account it is convenient to avoid planting branching trees, and their greatest height should be 5 metres and their leaves should be persistent. Such trees planted on the edges of the side-walks, these being 5 metres in width, will afford a useful shade to wayfarers, and will not injure the buildings; they do not prevent free ventilation; they regenerate the oxygen and develop electricity through evaporation and breathing. Streets with trees should be of 15 metres in width for vehicles, and 10 metres for the side-walks, which would give them a width of 25 metres.

The wind.—Nobody denies that miasmas are carried off by the wind, and it seems only reasonable to utilize this natural agent for sanitation purposes and to benefit mankind. If winds are allowed to reach the foot of front walls, dwellings will be ventilated and streets rid of miasmas.

When wind blows and meets with an obstacle, we may consider it as a liquid that glides, and we may to a certain extent apply to it the formula for liquids,[1] in which case, with a velocity of 3 metres and 10 metres altitude, the amplitude will be of 4.274 metres. It should be added that if the current be subject to collisions and retrocession, this will diminish its action, and therefore we will have to duplicate the former value, and the result will then be 8.578 metres.

By this law of currents, which, if not exact and rigorously proved, is at least very probable, I observed on February 12, 1891, that an isolated wall 3.55 metres in height gave an amplitude of 7 metres. On March 7, of this year, the observatory registered the enormous velocity of 19 metres, wind blowing from the west, and in the alley of Villasana (Toluca) that runs north and south, and is 6 metres wide (3.80 centre and 2.20 side-walks), the wind was so slight that it hardly waved the flame of a match.

Hygienic authors assign to slight winds the agency of a moderate tonic, lending activity to the functions.

Moreover wind, on account of its friction on walls, develops electricity, and even though it is still unknown how this agent acts on organisms, it is a well known fact that it exists in the atmosphere, and man's life is surrounded by an atmospheric mass that contains more or less electricity.[2]

If we bear in mind that vitiated wind contains an amount of miasma in proportion to the density of population, the result will be that the width of streets should be in proportion with the density, so that central streets and those contiguous to workshops, colleges, etc., should always be at least 19 metres in width.

The paved way.—Carriages and wagons are the most bulky vehicles, and if to these we add street cars, we find that a large portion of the streets are obstructed. I will suppose that a carriage has a length between axles of 1.80 metres, and of pole 2 metres; the line of 3.80 metres, total of both, supposed to be fixed, I will take as the chord of the arc of the radius we want to determine.

The proposition thus stated, all we have to do is to find out the diameter of the regular polygon which has the least number of sides, the length of these being 3.80 metres. Taking the equilateral triangle we will have a radius of 2.20 metres and 4.40 metres diameter; but as the effort acts centrifugally, and the angle of traction is over 30 metres, a great part of said effort is lost, endangering the carriage and its occupants, therefore said angle should be reduced at least one half. This can be reduced by

[1] $v = \sqrt{\frac{g}{2}\frac{a}{h}}$ in which v is velocity, a amplitude of reach of the traject, h height of fall and $-g$ the intensity of gravity (9.78 metres) for the capital of Mexico.

[2] It is convenient to make especial study on this subject and luckily, as one of the peculiarities of the central plateau, we possess a zone at its northern extremity, which I will call electric, that extends through Jilotepec and Ixtlahuaca, probably west and south. Among other persons who have spoken to me about this zone, I will mention Messrs. F. Rossenwieg, S. Graff, L. Salazar, Esq. St. Telmes fire is of frequent occurrence, and electric storms very common. This in my opinion can be explained by the hydrometric change the wind suffers on ascending to the central plateau.

doubling the sides, and the result will be a regular hexagon with a diameter of 8.60 metres.[1]

If we take this diameter as the width of the street-way, it will be enough for a carriage to turn around in, but in thoroughfares it sometimes happens that two carriages are turning round at the same time on the line of the same transversal axis, and in this case we would have to double the former quantity, and then we should have 15.20 metres for the centre width of ordinary streets with trees on them.

Carriages and wagons cause strong vibrations on the ground, and these act with more or less energy on the surrounding buildings; and for this reason side-walks should be broad, for by being made so they remove vibrations and are convenient to pedestrians. Ample streets, furthermore, afford room for building purposes, repairing of sewers, etc., so that these can be carried on without stopping transit, as it happens at present on account of the narrowness of the streets.

On the widest streets at Toluca (15 metres) it has very seldom taken place that contagious diseases have broken out, and as a general rule it can be assumed that, notwithstanding the very bad hygienic conditions of many of the houses, typhus does not spread as it was reasonable to be feared. The buildings in those streets generally have but one floor, and are from 6 to 8 metres high.

With streets 15 metres in width and blocks of one superficial hectare, the free aërial surface would be 30 per cent. and Paris has only 25 per cent.[2]

If 19 metres are accepted for the width, the amount of surface will be 38 per cent. and will come up to 50 per cent. if the width of the street is sufficient to plant trees on them. Washington is the only city that has 54 per cent.

There is still another reason why streets should be wider than the height of the buildings on them, and though we may be considered very trivial, it is in our opinion of vast importance. No house-front is finer than our sky, above all in the Central plateau. If a work created by genius inspires us with admiration, the scenery of the heaven's vault affords us an indefinable well-being, we feel at liberty even at our work; and that scenery gives us courage and may be the means of rendering life more useful and profitable. We should wish and try to carry out the idea, that each resident from his doorway may be enabled to enjoy the beautiful sky. "These seeming trifles," or, as many ironically will call them, "fine literature," are, however, supported by physiology and physiography.

SQUARES.

Squares in our country are generally found where we meet with churches, and we can judge of the veneration in which a saint is held by

[1] Claudel gives for it 7.80 metres. By the measurement of several revolving wheels set, the result has been 3 metres.

[2] Lacassegne. Précis d'Hygiene Edition 1885.

the extent of the square. It is true that squares where markets are held either periodically or continuously, and are therefore used for traffic purposes, should not have been laid out by Faith, but as she built the churches, and these are badly located, the same thing happened with the squares. In any way we can deduce a useful fact for our purpose, and this is it: Squares have a proportional area to the number of inhabitants that congregate there. It is but natural that squares being devoted to other purposes than those at first assigned to them, their conditions should be different. They should not be a meeting-place for disorderly and tumultuous masses attending religious festivities, but a free space where the inhabitants may congregate, if they wish or need to do so; and it is important to bear in mind that our social and political conditions exact that necessity.

In the times of viceroys it was ordered, on laying out a village, that at the centre of the settlement the church should be built, and from that building to each of the four winds 600 varas should be measured, and in like manner 1,200 varas should be measured from the village to the Estancia.[1] As to cities, the extreme irregularity of many of them, exceptions being made for topographical configuration, we must presume that it was due to neglect, or to private or general interests that could not be done away with. Life in Mexico has been and is a domestic one, and this is the reason for those large blocks (embracing as much as 5 hectares) which, originally owned by one or two persons, were afterwards sub-divided, some houses remaining with two, three, and even four courtyards. The dwellings not being laid out according to hygienic rules, and the courtyards not in proportion with the height of the walls, ventilation in the inner courtyards has to be effected through diffusion, and therefore is not as efficacious as is required.

Returning again to the villages, the surface of them, as we have stated, was 144,000 square varas, or 120 hectares 6,720 metres. This is equivalent to a square of about 1,100 metres. In some towns, on account of the size of the central blocks and the way they are laid out, we observe a tendency to locate the axis of the streets 100 varas equidistant,[2] or 83.80 metres; that would allow for 144 blocks, of which the two central ones were one for the church and cemetery, and the other for the public square. This circumstance affords us a useful datum, which is that *the blocks should not be very extensive, so as to facilitate transit*—and to this we can add now, *to avoid accumulation and afford direct ventilation.*[3] Such a disposition was not an irrational one, for if a common step is about a vara in length, each side of a block could be walked over in one minute and the outskirts of the settlement would be about twelve minutes of time from the centre.

The distance can be shortened by opening streets, according to the diag-

[1] Royal cedule, July 12, 1695.

[2] In city of Morelia among others.

[3] In Toluca and many other places, the stables and pigsties are in the inner courts, and those apartments, which should be the best ventilated, are far from being so.

onal of the square; but this would lead to many inconveniences: the dominant wind would make transit in those streets very troublesome, the sight of the dihedrons would be disagreeable, the distribution of the rooms in the dwellings would be defective, and the bad orientation of many of them would make them unhealthy.

Adopting circuits of 100 blocks—each of them with a surface of one hectare—transit, sanitation, and ventilation of dwellings would be facilitated, and the agglomerations of dwellers avoided. It would not be prudent to increase the circuits, for this would place dwellers at a great distance from the vertices.

As the dwellers of each circuit would congregate naturally in these squares, we must investigate what would be the right space for the citizens to occupy there, so as to be with ease and comfort. In blocks of one hectare from sixteen to eighteen buildings can be built, if the houses have only one floor. If we calculate ten persons in each dwelling, each block would have 360 souls, an enormous density for one hectare. But it must be borne in mind that on ground floors there will be workshops, stores, etc., and also churches and other buildings not used as dwellings, for which reason we can believe that 30,000 inhabitants would not be an exaggerated estimate.

Giving to the square one metre for each inhabitant, for the 30,000 of the circuit 30,000 metres would be required, that is three blocks, without taking in the necessary streets; and with the object of getting thus a regular shape, four blocks would be needed for each square.[1] In these dimensions there is no exaggeration, as the Sanitary Code of the Federal District assigns twenty metres of air in a limited atmosphere; and as to said cube a height of four metres is allowed, the base would then be of five metres. Then to the fifth part of that base, in an open space, we take a prudential minimum.

Before continuing I must remark, that though a square is the most agreeable shape and frequently adopted, it is not perhaps the most suitable for blocks in a town. It is at once perceived that, of the four sidewalks of a block, the northern one is the coldest, and as it cannot be suppressed, it should be reduced; furthermore, the longer a block's foot is the less powerful are the miasmas, carbonic acid, and other exhalations. It seems, taking in account the former reasons, that a rectangular shape is to be preferred, with dimensions of one for the east and west sidewalks and 3/4 for the north and south ones, without increasing the size of the block, which should only be of one hectare.

It is known that breath, combustion, fermentation, and many other causes vitiate the air,[1] that hygienic air should only contain about one per cent. of carbonic acid, and its hydrometric condition should be equal to seven grammes, at heat of 15.° With these elements and bearing in mind that by exhalations a healthy and clean individual vitiates ten metres in an hour, each candle light one metre, and a lamp six metres, that

[1] Toluca's main square now a public garden as about 7,000 metres.

[2] Portuandos lesson on agriculture. II Test. Kus en Lacassagne.

a kitchen fire consumes about 300 grs. of charcoal in an hour, and produces 1,100 grs. of carbonic acid, or 356 litres in an hour—bearing these in mind, if we calculate that a dwelling has ten souls, and three fires are made for preparing food, that four lamps and four candles are lighted, we shall find by day 266.8 metres, and at night 296.8 metres, of vitiated air. As can be seen, we have made no calculations for the domestic animals and the many fermentations, for if we had done so, more than 500 metres could be calculated hourly for each dwelling. Accepting 500 metres of vitiated air for one hour and one dwelling, the 36 of one block will amount to 126 metres and the circuit with 96 blocks to 1,209,600 metres. This production is continuous, and in the greater number of cases only diffusion operates in changing vitiated to breathing air.

According to Graham the velocity of a gas is in inverse ratio to the square root of its density. If 1 is the density of air, carbonic acid will be of 1.527, and the velocity with which this gas is diffused through a membrane would be about .82 metres. The velocity prescribed in ventilating dwellings is 1 metre and with this, wind is kept at less than 1 per cent., therefore we can take 1 metre as the velocity of diffusion of carbonic acid in the open air, without being liable to commit any error. Free diffusion, doubtless, obeys laws that change according to circumstances. In air not in motion, a focus of carbonic acid that does not give out heat will give a diffusion by radiation like heat, and it will spread in every direction. If there is a raising of heat, said acid will dilate, ascending in columns till its density is equal to the air that surrounds it, and at that elevation there will be diffusion through radiation. If the wind blows and the carbonic acid receives it, it soon disappears, but as wind does not always blow, many times diffusion is the only active agent.

The circumstance that, though phenic acid is volatile and diffusible, it leaves its stench for a long time in places where it has been used, though they may be well and perfectly ventilated, may induce us to presume that carbonic acid and miasmas are not thoroughly dislodged by diffusion, and that therefore air through this process is not converted to a perfect breathing condition. For this it seems natural to add to diffusion the regeneration of oxygen by means of plants, and more so if we reflect that through their action, air ozonizes and has a more efficacious effect on miasmas; in this manner two currents in different directions are produced, one towards the plants, impregnated with carbonic acid and miasmas, and the other with ozonized air in the direction of the dwellings.

According to Clöez 12 grammes of green plants exposed to the sun for twelve hours will give 245.3 c. of gas containing 210 c. of oxygen;[1] so that one kilogramme will yield every hour 1.458 l. of oxygen weighing 2.084 grs. and corresponding to 2.866 grs. of decomposed carbonic acid with an equal volume of the oxygen that it gives out.[2] If we suppose that

[1] Deherain Agricultural Chemistry.

[2] Though Becquerol assures that in a day—24 hours—an hectare of forest settles one kilogramme of carbon and Liebig holds the same opinion, Clöez's observations seem to be conclusive.

the carbonic acid contained in vitiated air at one per cent. should wholly be decomposed, so as to become breathable, each cubic metre of said air would require 68.586 kilogrammes of foliage in a confined atmosphere. The tops of trees have very different shapes, and this makes the surface exposed to the sun's light to be also very different.

However, a Troeno-Japan ash tree of a middling size may have up to 100 kilogrammes of leaves and green portions, but taking as an average 50 kilogrammes, each tree will hourly decompose 75 litres of carbonic acid and will cover a surface of 4.91 metres.

If we want to have a useful plantation of trees, we must plant it of at least three times the number of the inhabitants. However, let us accept one of the same number, that is 30,000 for each circuit. For this number we will require 15 hectares, that can be carried out only with streets 25 metres in width and four squares of four blocks each.

In places where the soil is naked, evaporation is rapid, and in Toluca the hydrometric state of the air is extremely changeable, it sometimes being at 20 per cent., and then doubling and trebling in a few hours. Arable land in the south and east parts of the city contains from 50 to 60 per cent. of sand, as by analysis made in the Institute in 1874 by Professor Cayetano Velazquez, deceased, and the author of this essay. In these circumstances the sun heats the ground extensively, above all if it be paved or flagged, as it seems that stones have a strong calorific capacity. Though no observations have been made on the calorific capacity of the soil and stones, it must be very considerable, for while paraffine and tallow melt in the sun's rays, these substances require a heat of over 30° to be fused.

By what has been stated we can account for the great heat felt on walking on the streets, for to animal heat are added the direct solar rays and those reflected by walls and pavements. This circumstance imposes the necessity of affording a shade to pedestrians, as also to parties in the market having no shade over their stalls, to whom the inconveniences that we have above referred to are aggravated by the grouping of customers.

Deherain asserts that one leaf weighing 0.185 gr. receiving the light of the sun through an alum solution, yielded in one hour 0.175 gr. of evaporated water, that is equal to 88 per cent. of the weight of the leaf, and in this manner the operator demonstrated that evaporation is produced by solar light. As the time of the year when light lasts longer is the same as when heat is stronger, a great benefit is derived by planting trees. Lawe has ascertained that the quantity of water evaporated from trees furnished with persistent leaves, is 50 per cent. and even more for pine and other plants. A surface of 15 hectares planted with trees yields for one hour 50 metres of evaporated water. This quantity of water is equivalent to an area of 50 hectares. Supposing them to be covered by water, this would evaporate freely by the sun's action, as evaporation in free air reaches to 0.01 m. daily, as by observations made at the Institute. It can thus be understood that plants tend

to maintain air in a good hydrometric condition for hygiene and without the drawbacks of the water that evaporates from the streets.[1]

By the observations of Lawe we can establish that trees with persistent leaves are to be preferred, for their clean lines demand a small expanse, there is no pretext for the forming of vegetable detritus, and, above all, because their leafy organs are in activity in all seasons.

As to markets it must be borne in mind that they should be roofed, surrounded by trees, and well ventilated, and their proper area can be arrived at according to the following statement: To the 30,000 dwellers assigned to each circuit, we can calculate that 10 per cent. go to market, and therefore it should have at least a capacity for 3,000 persons. In order that sellers may expose their merchandise, and space be left for the passage of purchasers, we should calculate a minimum of 3 m. for each person, which amounts to 9,000 m., or about one block. If one block is not to be had next to the square, that should only be encumbered with ornamental improvements in its perimeter. Convenient galleries could also be built in the squares, which, while serving for the purposes of a market, should be so arranged as to have a pleasant aspect without detriment to hygienic conditions.

As we have remarked, in a town, if the circuits are so laid out that from square to square—without including streets—there is a distance of 1 kilom. and the streets are planted with trees and the blocks of 1 hectare extent, the distribution would be comfortable, hygienic, and pleasant. Planting gardens in the vertex of each circuit the superficial distribution of hydrogen to the other ninety-two blocks would be increased by an amount equivalent to 92 hectares, which would correspond to more than 60 hectares of free surface and there would be very nearly 70 per cent. of free air. We should find but little difficulty in locating schools, public offices, etc., so that those buildings should serve their purposes in each circuit.

As to old cities that are so deficient in those conditions, it would be good policy to limit their growth by means of a wide thoroughfare circuit, well located, and then the newly laid out blocks should be rigorously subjected to the regulations decided upon as most advantageous to the well-being of the inhabitants.

However hazardous and incomplete the results that have been given may be, they are more rational than those based on guess-work, caprice, stubbornness, and if they are acceptable, all good citizens should lend an aiding hand to carry them into practice, remembering that as law impartially deals justice with equality among all, so society should afford to all residents sun, light, and oxygen. There is no doubt that the efforts of the authorities should tend to man's physical, moral, and social improvement. And therefore we should strive to regenerate oxygen that vivifies, and destroy carbonic acid and miasmas that slay man.

[1] Pavements being absorbents, animal urine and other liquids must produce miasmas when the water used for sprinkling the streets evaporates,—more so when it is not clean. It is certain that pavements are subject to detrition and, also, it can be affirmed that sprinkling, or a sudden lowering of temperature, may injure the breathing organs of the fatigued pedestrian.

Let schools be established where man shall be taught to love the Fatherland, to do to his neighbor as he would be done by, to feel a pride in all the branches of trade and professions that ennoble him.

Let towns, villages, and hamlets be provided with ample squares and streets, so that man, feeling that he is not confined to the narrow limits of dirty and unhealthy alleys, and that the freedom of his actions is untrammelled, may see in all those blessings the incontrovertible proofs of the grandeur of his mission—to live performing worthy deeds.

XXXVI.

IMMUNITY OF THE CAPITAL OF THE STATE OF MEXICO FROM PALUSTRAL COMPLAINTS.

By Dr. JUAN M. CAMPOS,

Toluca, Mex.

The supreme government of the state having invited, at the suggestion of the Mexican commission, this board of health to collaborate in the presentation of a work to the hygienic congress, which is to meet in Mexico next November, in view of the importance of the conclusions to which it is devoted, we have not hesitated in choosing as a theme of the said work, the elaboration and demonstration of a fact that deserves, in our opinion, a minute study, and is confirmed by the statistical data collected in the office of civil records and in accord with this memorandum, as is also the testimony of all the doctors who exercise their profession in this locality.

This fact is the scarcity of marshy soil in this city, and the beneficial influence exercised by its climate and other conditions on patients, who, attacked by this illness, remove to it from other places. Taking this fact, in a general manner, in consideration, as being confirmed, we will study the climatic local conditions, and all those that can influence in this result—this study constituting the work that we have the honor of presenting in answer to the said invitation.

It is well known that the conditions favorable to the growth of the said palustral complaints, conditions that are found united in the countries where they reign, are an impermeable subsoil and little or no inclination of the ground, which, not permitting the easy absorption of rain-water, cause pools of stagnant water. After the rainy season these pools remain full of vegetable residue and all the conditions are found united to facilitate the decomposition of these organic dregs; for, subsequent to the said season, the weather is generally warm.

The miasma resulting from this decomposition is the known universal cause of paludous fevers.

The data inserted in continuation show clearly that these conditions are realized in the locality to which we refer, whence is deduced its immunity.

The city of Toluca, the capital of the state of Mexico, is situated at 19° 17′ 30″ 4‴ north latitude, and 1′ 59″ 97‴ west longitude, meridian of Mexico. It is in the interior of the valley of the same name, in a dale watered by a small river, which crosses the town from south-west to

north-east, and formed on the south by the volcano called "Nevado de Toluca," which is now extinguished, and on the west and north by the mountains of Coatepec, Teresona, Toloche, Carmen, and Huitzila. The plain on which the town is founded is one of the highest elevations in the Republic, for it is 2,625 metres above the level of the sea, and 417 metres above the City of Mexico, and has a general inclination from south-west to north-east of 0.01 m. of declivity. The country round it can be divided into two parts. The north part, extending to the principal square, commences at the trachytic rocks of the mountains, on which rocks there is found a layer of fluvial tophus, and another thin one of sandy soil. The lands on the south-east and west are alluvial ones, such as pumice tophus, great alluvions, strata of sand, and in some zones beds of gravel. The auriferous strata or layers are of little depth on the west, but are deep on the north and east of the city. This geological formation of the country, united to its inclination, makes it easy for the fluvial waters to flow with ease and rapidity through the river bed that serves as a drain, and leaves the town dry very quickly after the rain.

The climatic data of the city are as follows:

The average temperature in the year is 12.91° Centigrade.
The average temperature of each season is,—

Spring	12.50° C.	Autumn	14.40° C.
Summer	14.56° "	Winter	10.18° "

The relative average humidity is 70.43, and in each of the seasons as follows:

Spring	60.70	Autumn	77.12
Summer	65.30	Winter	75.23

The dominating wind is from the south-east, and its average velocity is 1 metre 24 centimetres per second.

The maximum barometric pressure is 558.90 mm., the minimum 554.31 mm., and it is noticed that it takes place respectively in October and November, and in March and April.

The maximum quantity of ozone is 7°00, the minimum 1°00, and it is impossible to fix absolutely the time it takes place, as it is subject to a multitude of variations.

The velocity of the water in the rainy season is 0.67 m. per second.

In the dry season the velocity diminishes more or less, according to the absorption and class of land over which the water flows.

Its population of 20,000 inhabitants is composed principally of individuals of medium vigor, of lymphatic-nervous temperament, given in general to agricultural pursuits and mechanical arts, most of them of the poorer classes. All these circumstances explain the presence of the dominating diseases, which are catarrhal affections, congestions, pulmonary emphysema, typhus, typhoid fever, and cancer.

The study of all these geological, topographical, and climatic conditions, which surround the capital of the state of Mexico and which we have already enumerated, and their comparison with the conditions favorable to the growth of paludic affections, easily lead us to establish several conclusions.

1. The city of Toluca is not propitious to, and we can even say is almost exempt from, paludous fevers, seeing that its soil is of sufficient inclination to allow the fluvial waters to pass with ease, thus preventing the formation of marshes.

2. It being the principal object in the treatment of any illness to suppress as much as possible the causes which favor or determine it, so it is obvious to say that, palustral diseases not existing in Toluca and its atmosphere being besides well purified, the cure of these diseases is wonderfully facilitated in this locality.

3. From the above conclusion it is inferred that the said town unites the greater number of circumstances desired to constitute a sanitary station where patients may go for a quick and easy cure.

These conclusions, deduced theoretically, as we have already said, from the conditions of the place, are fully corroborated by practice, according to the statistical data that follow.

STATISTICAL TABLE OF MORTALITY FROM DISEASES OF PALUSTRIC ORIGIN, COMPARED WITH GENERAL MORTALITY.

YEARS.	General mortality.	Mortality from paludous diseases.	Mortality per 1,000 during ten years by paludous diseases.
1881	1,694	0	2.30
1882	1,822	1	.....
1883	1,565	2	.....
1884	1,796	5	.....
1885	1,736	5	.....
1886	2,317	4	.....
1887	2,156	4	.....
1888	1,826	11	.....
1889	2,269	6	.....
1890	2,116	8	.....
1891	1,603	4	.....
1892	1,624	1	.....
Totals....	22,524	51	2.30

In order to appreciate properly the above data, we think it necessary to make a few explanations: These data refer not only to the capital, but to the whole municipality, but notwithstanding this, cases of paludous fever are very rare compared with the general mortality. It must be added also that, except in the capital, in almost every town patients are without medical assistance, and certificates of death are given in the locality, classifying the disease that occasions death according to the knowledge of the patient's relatives. It can be easily seen that data thus obtained are not as exact as they might be, coming as they do from persons entirely uneducated in medical lore. Lastly, the municipal towns are inhabited by a multitude of muleteers, who in their journeys to the hot lands and to places full of the diseases of which we are writing, can become affected by them in these places. Their poverty and the nature of their occupation do not permit them to suspend their journeys to submit to a formal cure, with the result that on account of the roughness of their life and their bad, unnutritious food they soon contract palustral cachexy, which causes their death.

Taking the above statistical data at their true worth after the enumerated considerations, it is clear, as we have already said and as we repeat, that the trend of the numeral data corroborates our assertion. In conclusion, we will say that the statistical data refer solely to a period of ten years, because since that time they have been authorized by the issue from the faculty of death certificates.

We think we have concluded this imperfect work, only wishing that it may be of some use to patients and to our professional colleagues.

XXXVII.

DEFENCE OF THE PORTS AND FRONTIER CITIES OF MEXICO AGAINST THE EPIDEMIC OF CHOLERA THAT INVADED EUROPE AND WAS ON THE POINT OF INVADING THE UNITED STATES IN 1892.

By Dr. EDUARDO LICÉAGA,

President of the Board of Health, Professor of Operations in the National School of Medicine, and Director of the Hospital of Maternity and Infancy.

Mexico.

Gentlemen: The reading of the interesting statements of Dr. Bell, of Dr. M. C. Van Bibber, of Dr. V. Blake on quarantines, that of Dr. W. M. Yandell on contagious diseases on the banks of the Rio Grande, and that of Dr. Geo. Homan on disinfection by means of steam of high temperature, inspired me with the idea of showing before this Association the means we are using for the defence of our ports against contagious diseases, and those we propose to establish for our frontier cities.

If the means that in all times have been put in practice to prevent the propagation of contagious diseases are studied, it is found that they have been either the isolation of sick persons, so that they shall not communicate their illness to those who are well, or the isolation of healthy individuals so as to avoid any contact with the sick ones. This isolation has been made by sanitary codes in lazarettos, with separate departments for patients, for those suspected of illness and for those in good health; or in especial hospitals, destined for each one of the different species of contagious diseases.

The defence of the ports has been effected by a notice that no infected ship shall be received or be put in communication with the port for more or less time entirely changeable, and of whose duration there is not the slightest scientific arrangement, it being very often dictated by fear, by want of good means of defence, or by other novel considerations that are not in scientific order. In the ports where ships are accepted, special anchoring ground is set apart for them, where they can be cut off from all communication with the port or with ships anchored in the bay.

When the topographic conditions of the port will permit, one of the lazarettos of which we have before spoken, is established on an island near by.

Another form of lazaretto, especially destined for yellow-fever, is to be situated, not on the coasts nor on the islands, but inland on a height, where experience shows that yellow-fever is not propagated. The government of the State of Veracruz has a project for building a similar one in "El Fortin," between Cordoba and Orizaba, and our illustrious confrère, Dr. D. W. Blake, will speak to-day before you on lazarettos on heights, to prevent yellow-fever, with a great store of facts and with details and ideas which make his work very valuable.

There is another and entirely modern mode of isolation, at least in its form, and especially applicable to the first cases of an epidemic: it is the isolation of the patient, or of several patients, who are put in the same house and who are absolutely cut off from the inhabitants, from the neighboring houses, and from the rest of the city; it can be said of this, that the isolation of the houses is on the same principle as the quarantine of ships.

All these means tend to realize this sole thought: to prevent communication between the sick and the healthy individual, and the more vigor used in carrying out this principle, the more certain are the results.

The other resource, entirely modern, at least in its application, is disinfection. Its object is this: to destroy by natural or chemical agents all germs, whatever they may be, which produce contagious diseases. This resource has been perfected with rapidity in this last year by a series of experiments, which defined with an almost mathematical precision the action of the natural, and of many chemical, agents on the life or virulence of a great number of the known microbe organisms. These studies have given surgery the means of operating with almost complete harmlessness. Applied to illness of medical order they have consisted of fumigations, fatal to the inferior organisms, the principal of which are chlorum in its nascent state, sulphur in the form of sulphurous acid, steam under pressure, etc. The solution, carbolic acid, bi-chloride of mercury, sulphate of copper, sulphate of iron, that of zinc, etc. The infected objects are submerged in solutions of these in well defined proportions. The bi-chloride of mercury in a solution of a thousandth is pulverized in a special apparatus and is sprinkled over the contaminated objects, a means of destroying all the germs by direct action.

We said before that the application of these means was formerly made in an empirical manner and founded only on the lessons of experience, but with the progress of science it has been converted from an empirical remedy to a proved application; and in a great number of cases has succeeded in re-investing the characters of scientific precision. In the experiments of this character, which have been made in France, in Germany, in England, and in your own country, the results are too well known to you for me to take up your attention with them. It can be thus seen that the means that are actually in use to prevent a transmissible disease from passing to a healthy individual from a sick one, are isolation and disinfection.

The first of these is of undoubted efficiency, always providing it is

complete and that the time is prolonged sufficiently; but it has the serious inconvenience, when it is applied as an international police measure, of interrupting commercial relations between the countries and making communication difficult between the inhabitants; and these circumstances seriously hurt the greatest material interests, a conflict is waged between the preservation of health and public and private wealth.

If the public spirit is dominated by fear, on seeing the country invaded by an epidemic like the cholera, under the influence of the panic a decree is issued, stopping the entrance of ships in ports, and quarantines imposed of the most severe character; but the more rigid the restrictions, the more private interest is menaced and tries to evade them at any cost.

The rights of humanity frequently disappear before the interests of commerce.

As there is more severity when ships have sick people on board, or have just had them, the captains or owners of the ships hide these facts on reaching port. And on their declarations their ships are admitted freely, and persons who have diseases in the period of incubation or just recovering from them are put in communication with healthy people, and thus originate an epidemic that may cause the illness or death of thousands. In Toulon and Marseilles, on various occasions, ships have arrived from India with cholera patients on board; their captains have declared falsely that the sanitary state of the ship was good; they have been admitted with their cholera patients and convalescents or passengers who had the germ of the disease, or baggage soiled with choleric evacuations, that have developed in those ports and devastated the eastern countries of Europe. In the port of New York, in spite of a very severe quarantine having been decreed of twenty days, in the month of September last four or five cases of cholera were observed, which could only have appeared there by the quarantine having been avoided. Thanks to energetic measures, to excessive vigilance, and to the complete isolation of the patients, the epidemic was arrested in its infancy and its propagation through all the states of the Union prevented.

The danger of false declarations is not altogether remedied by the custom of bills of health, for we know that the senate of Hamburg was giving *clean* bills of health to ships sailing from that port, when the epidemic was already there. The authorities of the port of Ambères declared their port *clean* when they also had the disease.

There are dangers of another kind, that depend on the situation of healthy passengers who have to remain in the ship with patients ill of cholera,—for instance, in a ship that is in quarantine—and they struggle to leave the place where they are constantly menaced with danger, and aided by fear and affliction they have recourse to every imaginable means of evading the quarantine.

An excellent statement, read to you by the distinguished member, Dr. M. C. Van Bibber, treats this subject with much extension and ability, and proposes the means to avoid the danger pointed out, but a long time

must elapse before his beautiful propositions can be realized in all ports.

The question of quarantine has again been submitted to study, bearing in mind, on the one hand, the unavoidable obligation of guarding against the cholera; and on the other, the unquestionable convenience of putting the least number of obstacles to commerce and to favor communication.

In the month of January of this same year a sanitary conference was held in Venice, attended by delegates, physicians, and representatives from fourteen of the most powerful countries of Europe who have an interest in the Mediterranean and the Suez canal. Science was represented in that congress by the most competent authorities on sanitary matters, and those most versed in the prophylaxis of cholera; and commercial interests by old diplomats, who have defended them with success on other occasions. The resolutions were at once adopted by ten nations, then by other three, and in the month of June of this year Great Britain gave her acquiescence.

In that conference the conditions of the quarantine service were modified substantially to this form: the ships coming by the Red sea with cholera patients on board, leave them in a sanitary station established in "The fountains of Moses," in isolated hospitals; the other passengers are subjected to observation for five days, while the baggage is being disinfected, and afterwards they are permitted to cross the Suez canal, but always *in quarantine*. When there are no patients on board, but there have been, the duration of quarantine can be reduced on condition that the ship have a disinfecting stove and a doctor to direct its management. If these conditions are complied with, and it is a question of mail steamers, permission can even be granted for them to cross the Suez canal *in quarantine*. I think these decisions should be taken into serious consideration, in order to modify the quarantine practice advised to our governments.

The Superior Council of Health, on proposing them to the executive of the union, took also into consideration the fact that the ships coming from Europe take at least eighteen days to arrive at one of our ports, and even from New York the voyage never takes less than seven days.

For this reason the council resolved to propose some reforms to our Sanitary Code, referring to the duration and conditions of quarantine, without losing sight of the fact that the spontaneous loss of the virulence of the morbose germs by the expiration of time is not now the essential basis of this measure, which is the consideration of how to avoid the material contact of sick or convalescent persons with those in good health, or to prevent persons apparently well on account of being in the period of incubation of the disease, from coming in contact with healthy ones; when the illness shows itself it will have been already communicated. So that the duration of quarantine ought to be the same as the longest period of incubation of a disease.

Apropos of the cholera, which has been the motive for this study, there is no really technical understanding, so that hygienists have been

unable to instigate to legislators any fixed periods, or if they have marked them, they have been excessively long, founded more on prudential rules than on scientific data.

In our case the council avoided this difficulty by pointing out the time that a voyage lasts from the ports attacked by cholera to ours; but for their decision in particular cases they have always named the period of seven days for incubation, in which the generality of hygienists agree.

How can it be objected that there are cases where the disease has shown itself more than seven days after the disappearance of the last case? I will anticipate by stating my conviction that those cases have not been of transmission from a sick to a healthy person, but of preservation of the germ in floors, furniture, mattresses, bed-clothes, and underclothing, whence a healthy individual could take the disease a great many days after the death of the last cholera patient.

My friend and companion in the council, Dr. Nicholas Ramirez de Arellano, read a statement in the international congress of Berlin, on the Asiatic cholera that broke out in Chiapas in 1883, in which he mentions a fact that has for us the seal of authenticity, and it is that cholera was kept in the unwashed clothes of a soldier who was in contact with patients, and having travelled for two months without bathing or washing his clothes, took the contagion to a town that was perfectly healthy.

There are many facts like these in science, of undoubted authenticity, demonstrating the possibility of the germs being preserved in clothes, and thus transmitted as surely as from contact with patients, and from this danger even a quarantine of two months would not preserve us.

This insufficiency of quarantine for cases in which the period of incubation of cholera has passed, in those precisely when the germs do not remain in men, but in ships, in furniture, in mattresses, in clothes, in coaches, in *susceptible* goods, etc., is that which demands *disinfection* as necessary and indispensable. It ought to be obligatory to ships that have had patients on board, although they may not actually have them then, in cases when the last port touched at was infected, because they could have embarked passengers or cargo that had been in contact with patients of cholera, and when a ship has taken passengers or cargo on the sea. In all these disinfection must complete the effects of quarantine, that is to say, of isolation.

As we have already said, disinfection used formerly to be made in an empirical manner; in proportion as experience has advanced its application has been more and more rational, and now that we have better means of destroying the bacillus of cholera, antiseptic substances are applied, not to all the ship nor to all the cargo, but only to the places that were occupied by the patients, in clothes and everything touched by them.

Leaving these ideas, the conference of Venice agreed that disinfection should not be made as formerly, and established the rules, as we said, that ships should be provided with disinfecting stoves. These being used during the voyage preserve the sanitary state of the ship in con-

stant good order, and on arriving in port the passengers need not be detained. The steamers of the French Transatlantic company, which come from St. Nazaire to Veracruz, for the last few months have brought disinfecting stoves and doctors to direct the operation properly.

If ships do not possess these resources, on arriving at a port they are necessarily subjected to these disinfecting operations by the sanitary authorities. These are recommended by the council and are: the burning of sulphur or the application of a solution of bi-chlorate of mercury by means of a special apparatus from the model by Genestte & Herscher, and which has been sent to the ports of Progreso, Veracruz, and Tampico. The first should be applied to the infected parts of the ship, such as cabins, holds, and other departments, which ought to be hermetically closed, but guarding against fire; white-wash for the floors, walls, furniture, etc., that have been soiled; carbolic acid and sulphate of copper for the water-closets, and a spray with bi-chlorate of mercury in solution at a thousandth, for all other *susceptible* cargo or baggage which should be disinfected without disembarking them, if they go in transit; but those which have to remain in the port, and the baggage of passengers who have to disembark, should be disinfected in a special room that serves as a provisional stove.

These last means of disinfection were recommended in the meantime until every port is provided with a stove, which will serve for all effects. Of these a sufficient number has been sent for, to the house of Genestte & Herscher of Paris, for the ports of Progreso, Veracruz, Tampico in the Gulf, and Acapulco and Mazatlan on the Pacific.

Disinfection by this apparatus is a means of well known efficacy in all parts, and on which a study was made by the most distinguished confrère, Dr. Homan, which he read to this same assembly.

Finally, the most efficacious mode of disinfection is by steam from water submitted to pressure and to a superior temperature to 112° C. After this come the other chemical disinfectants, but to be as efficacious as the first they must be applied with extreme care and perfection, and are destined to work *in situ* on the germs, as we have attempted to demonstrate in these notes.

Before ending the subject of disinfection I ought to speak of a practice that we intend to propose among the reforms to the sanitary council, and that we have already utilized with the ships that come from Hamburg to the Republic. I wish to speak of the *disinfection of ships* made in the infected ports. We have copied this practice from that followed by the United States of the North in the last epidemic, and when it is well regulated and perfectly executed it may diminish the duration of quarantine, and even suppress it if the disease has not shown itself on board of the ships that make long voyages.

As one of the circumstances that make quarantine inapplicable and the means of disinfection less severe, is the habit of the captains of making false declarations, the sanitary council consulted the government on the propriety of consuls abroad advising by cable of the sanitary state of the

ships leaving the port of their residence for ours, besides the notes made on the respective bills of health.

Here is the total of principles and considerations that served the sanitary council to propose to the government of the republic the series of measures accepted by the secretary of state, who circulated a ministerial circular on the 1st of September of the present year which is annexed, marked I.

When official notice was received that there were cases of cholera in New York, the council of health proposed another series of measures, founded on circumstances before mentioned. But as it was a question of protecting the extensive frontier on the north that separates us from the United States, and as vigilance over the whole would be absolutely impracticable, it was resolved that all communication between Mexico and the northern republic should be only by those cities by which railways cross the frontier, and which are from east to west, the following: Matamoros, Laredo, Piedras Negras, Paso del Norte, and Nogales, and besides the town of Tijuana in Lower California.

Dr. Bell, in an article on quarantine, which he has read to this Association, acknowledges the right of governments to defend themselves from epidemics coming from foreign countries.

In exercise of that right the entrance of passengers into Mexican territory ought to be prohibited, if they are already sick with cholera. Those who had any suspicious circumstances could be detained for twenty-four hours to be observed. All passengers would have to submit to a rigorous inspection, and when the sanitary agents had become convinced that they were in good health they should be asked their point of destination, so that they could be watched there for seven days, with the object of seeing whether the illness showed itself in them.

This measure, intended to surprise the first case of cholera that developed in the republic, is of an undoubted efficacy; it has the advantage of not imposing on the passengers an interruption to their journey nor to interrupt traffic, and makes the lazarettos of observation unnecessary.

In order to avoid the before mentioned consequences of false declarations of passengers, a rule is established to disinfect all baggage. For the present this operation would be performed by sprinkling bi-chlorate and by burning sulphur in closed rooms, and later by means of the disinfecting stoves, which are already ordered from the house of Genestte & Herscher of Paris.

As the carriages of trains can be infected by choleraic patients, it is obligatory to change them on the frontier, except the cars that bring goods when these are not *susceptible*, and a previous disinfection of them.

To secure the execution of these measures, sanitary stations will be established in determined places of the cities of the frontier.

The government would reserve the right to detain trains for a time not exceeding twenty-four hours, but only in case of imminent danger to the public health.

These are the considerations that inspired the circular of the 19th of September of this year, for the defence of the northern frontier of the republic. Annexed as II, that document accompanies this.

I am going to show you now how the federal sanitary service is conducted in the republic. For all international subjects the states of the Mexican Union form only one. The ports and frontier cities directly depend on the federation.

The ministry of state form the sanitary staff with this object, and have the board of health depending from them; from this again depend the sanitary councils of each frontier city and port, presided over by a delegate named by the government, and besides the number of agents that are judged necessary in case of an epidemic.

This staff is ruled by the Sanitary Code and by the ministerial circular of which we have spoken, with entire independence from the powers of the states, but only in the matter of international sanitary police.

In the case of an epidemic the council is constituted into a permanent session and receives all the notices of ships leaving the infected ports, telegraphic messages sent by the delegates advising what ships arrive at each port of the Gulf or of the Pacific, pointing out their proceedings, the number of days they have taken for the voyage, the ports where they have touched, if they had communicated with other ships on the sea, the number of passengers and of the crew, their sanitary state, the quality of the bill of health, and as much information as can interest the public health.

As almost every case is foreseen in the circular, the delegates of the council can, according to special circumstances, impose the rigorous quarantine or that of observation, make the disinfection of the ships only or also of the goods they disembark, of the baggage and clothes of passengers who remain in that port, or the simple inspection of passengers and crew; and lastly, if all the conditions are favorable, put the vessel at liberty.

The *Galicia* sailed from Hamburg for our port of Progreso, when the cholera had already shown itself in that city, but before the senate had made the official declaration of its existence; the ship came with a clean bill of health vised by our consul. If we had received it under those circumstances, it could have brought sick persons or infected clothes and would have spread the epidemic on our coasts, but the consul in Hamburg advised us by cable that the *Galicia* in spite of bringing a clean bill of health ought to be regarded as suspicious. The council advised the delegates of the ports of the gulf, who subjected the ship to the quarantine measures that corresponded to her, coming as she did from an infected port. This is why the measure, that consuls abroad should advise by cable the modifications to be made in the bill of health, was passed.

This organization of the sanitary service has been put to the proof during the last three months, and the experience acquired in this time has suggested some modifications that we intend to propose to our gov-

ernment, but which only relate to details, for in the main the results have been satisfactory.

To assure the strict execution of the measures contained in the circulars of the 1st and 9th of September, the council compiled some instructions for the delegates in the ports and for the sanitary agents in the frontier cities, which are added to this statement as III and IV.

To finish, I ought to inform our estimable confrère, Mr. Yandell, that disinfecting stoves are going to be established in Paso del Norte and in the other frontier cities, and sanitary measures will be put in force which were dictated even before knowing the interesting news communicated to us by our esteemed fellow-worker in this study on contagious diseases on the banks of the Rio Grande.

APPENDIX.

I.

The President of the Republic, by and with the advice of the Superior Sanitary Council, bearing in mind that there have been cases of cholera in several parts of Europe, and that through them the epidemic may possibly be communicated to our country; with the object of avoiding it and employing the best means and with the least possible damage to commerce, has deemed proper to enact that the following rules be enforced, until otherwise provided for:

1. Veracruz is the only port on the Gulf where the prescribed quarantine can be purified out.

2. In each of the other ports of the Gulf, an anchorage ground will be marked out for vessels to purify out the observation of the quarantine, under the conditions that said vessel must remain completely isolated, both from land and from all other ships anchored at the port.

3. At Veracruz, the delegate of the council will be aided in the performance of his labors by one of the doctors of the port's Board of Health.

4. In other ports of the Republic where there is a delegate of the Council, the carrying out of these measures is entrusted to said delegate and to the Board of Health appointed, as provided by in the 8th article of the Sanitary Code.

5. At each of the other ports a doctor will be appointed pro tem. to act as council delegate, in accordance with the provisions of the 11th article of the code referred to.

6. In compliance with article 15 of said code all vessels that arrive in port shall be visited, all exceptions that may have been granted in favor of coasting vessels or others ceasing, in case that said vessels are considered as suspicious on account of having come in contact with infected vessels.

7. In compliance with the dispositions dictated by the executive, dated January the 10th of this year, on the arrival of vessels, the delegate of the council, the captain of the port, and all other officers that are deemed necessary, will sail out on board the longboat belonging to the capitanry to visit them. They will hoist the yellow flag so that the captains or mates may be apprised that the health com-

mission is on its visit. Once on the side of the vessel the delegate will inform himself if there are on board any cholera or choleraic diarrhœa patients, if there have been any during the passage, if there were any at the time of setting sail, how many days has the vessel been on her passage, if she comes from an infected port, if she has touched any port where there is infection, if on sea she has held communication with any vessel hailing from such ports and from which she may have shipped over passengers, how many passengers she has on board, the number of her crew, and all other information that he may deem necessary to become thoroughly acquainted with the sanitary conditions of the vessel.

8. If the ship has a doctor on board, he shall give in writing and in the form of a certificate the foregoing information.

9. If by the information gathered it should be found out that there are on board cholera or choleraic diarrhœa patients, or that there have been any in the last seven days of the voyage, that the ship has no convenient stove for performing the disinfection nor a doctor to direct it conveniently, the ship shall go to Veracruz to purify out the quarantine, at the lazaretto of Sacrificios hoisting up the yellow flag. There the patients shall be landed and attended to in the department set aside for the purpose. The healthy passengers shall remain on board, and in the meantime the disinfection of the dirty clothes used by the patients, the baggage of the cabins, *susceptible* merchandise, the ship or that part of her that has been considered specially infected, shall be made. If there are any rags from the infected port, they must not be received while there is no disinfecting stove in the ports.

10. If after five days of observation there is no case of cholera among the passengers, free communication shall be allowed to them, and the vessel shall return to the port she is bound to, if Veracruz was not her final destination.

11. If there are no patients on board, but there have been some during the passage, no new case having broken out in the last seven days of the voyage, the vessel shall be sent to the special anchoring grounds appointed at each port, she shall hoist the yellow flag and remain for five days in observation.

If in that time any new case of the disease should break out, the vessel shall go to the lazaretto of Sacrificios, and shall be treated according to the dispositions set forth in articles 9 and 10.

In the time of the quarantine of observation, the dirty clothes of the crew and passengers, baggage of the cabins, berths that were occupied by the last patients, and every infected place in the ship, or those soiled with their dejections, shall be disinfected. Only *susceptible* merchandise shall be disinfected without unloading.

12. If the ship is in the condition stated in the former article, but has on board a disinfecting stove and a doctor who has proceeded to execute it according to the dispositions of this regulation, she shall remain in observation at the special anchoring ground, but the length of the quarantine may be reduced to three days if the delegate of the council deems it proper.

13. If the vessel comes from an infected port or has touched at any in that condition, or at sea has had any communication with an infected ship, but without having had any patients of cholera or choleraic diarrhœa on board, she shall be submitted to a quarantine of observation, the length of which shall be of two or three days as provided by the delegate; in the meantime the disinfection as heretofore provided in the former articles shall be performed.

14. If the ship should be in the conditions mentioned in the former article, but has a doctor on board and disinfecting stove, and this has been performed in a satisfactory manner, in the delegate's opinion, and the vessel is on its way, the same delegate bearing in mind the number of days that she will require to reach her port of destination, may allow her to continue the voyage in quarantine, having hoisted the yellow flag.

If the port to which she arrives is that of her destination, the length of the quarantine may be reduced to less than two days, according to the opinion of the delegate.

15. If more than fourteen days have elapsed since the day the vessel set sail from the last infected port, if she has had no patients, if she is in good sanitary conditions and has on board a physician who certifies to said facts, the delegate can board the vessel, examine her manifest, roll, etc., examine the passengers if he deems it convenient, and name the least minimum of length of the quarantine observation, and in the meantime the disinfection shall be performed in the manner prescribed for in the former articles.

16. If after the intelligence gathered by the delegate the vessel is found not to be within the cases provided for in the former preventions, and if she furthermore has a clean manifest, she can at once be allowed to free communication.

17. To compare the declarations of the captain or master of the vessel, our consuls abroad, besides stating in the manifest the sanitary condition of the port and the vessel herself, will report by telegraph in cases of unclean manifests said fact to the Superior Sanitary Council, stating the date when the vessel set sail and the port where she is bound to.

The council will on receipt of said advice transmit it without delay by telegraph to the Sanitary Board of the port of entry of said vessel, reporting at the same time all the facts in the case to the Interior Department.

The council's delegates at the port where any vessel may arrive with an unclean manifest, or in any of the conditions stated in the former article, will report by telegraph the fact to the Superior Sanitary Council, and also to the delegate of the port where said vessel is bound to.

18. The captain and masters are in duty bound obliged to prevent any kind of vessel coming alongside of theirs. They must not land nor allow anybody on board to do so, neither shall they be allowed to board any other vessel at anchor while their vessel has not been visited by the Sanitary Commission and allowed free communication.

19. If any of the crew or passengers of a ship should board any other of the ships at port or land before the sanitary delegate has examined her, and from his examination it should appear that the vessel must be placed in quarantine, the party who under the conditions before mentioned has left the ship shall be compelled to return on board to spend on her the quarantine term.

20. If by oversight or neglect any of the parties on the sanitary long boat should come in contact with any of the crew or passengers of the vessels which have to go to quarantine, he must remain on board all the time that she remains there.

21. The bodies of the deceased, who die on board or at the lazaretto, will be buried in the sea in the usual form.

22. In all cases, vessels will be disinfected by means of solution of bi-chloride of mercury, one thousandth, or by sulphur combustion, applying these substances

according to the special disposition of the several departments of the ship (holds, passages, saloons, cabins, &c.), and paying special attention in disinfecting dejections, clothing, and soiled places.

23, The lazaretto physician at Veracruz shall superintend the disinfection of the baggage, dirty linen, and wearing apparel of the crew and passengers, taking special care of all those soiled with the dejections of those attacked by the cholera. At the other ports a special commissioner shall superintend this operation, so that in no case the delegate physicians shall be endangered, and may always be in a condition to fulfill the duties entrusted to them.

24. In each one of the ports a small disinfecting department will be set up for the passengers and crew, and when it is possible they will be furnished with baths.

25. All merchandise will not be disinfected, but only those that are *susceptible*. Of those, the following are classified as such: baggage and wearing-apparel, rags, hides, leather, feathers, horse-hair, animal remains in general, wool and unbaled manufactured goods of this fibre.

26. In conformity with the 28th article of the Sanitary Code, all dangerous matters to contagion, or such as their disinfection cannot be satisfactorily practised, shall be destroyed by fire; the main articles referred to in this prescription are straw and hay that may have been infected, more so if they have been used in pillows or mattresses, rags, old shoes, things used to cure with, and worn-out mattresses and bedding that have been soiled by dejections.

27. Even when the time of quarantine is over, to which a vessel has been subjected, she shall not be allowed free communication, unless on the re-inspection visit it is proved that all the requisites provided for in this regulation have been complied with.

28. Private parties and consignees of vessels can, when they wish it, send any physician they choose to attend on their relations or friends, provided said physician has a legal title; said physician shall remain at quarantine all the time that the incommunication lasts.

29. When a vessel arrives with diseased parties on board, and the sanitary delegate places her in quarantine, the agent will watch to the changing of the patients, so to avoid their being hurt, and he will also be careful that they communicate with nobody, except those charged with their assistance and care.

30. If the sanitary authorities entertain any doubts about the compliance with any of the former dispositions, they shall consult by telegraph with the Superior Sanitary Council.

31. The infringement of any of these measures will be punished in accordance with article 327 of the Sanitary Code.

32. All these dispositions will be likewise carried out at the ports of the Pacific, but only the lazaretto on Roqueta island at Acapulco will be the one used to purify out the rigorous quarantine.

And I transmit it to you, for your knowledge and compliance, at the same time recommending you to use your influence with the corporation of that locality to appropriate the necessary amount to provide for suitable quarters for disinfeecting clothing and baggage by means of sulphurous acid, as well as to provide the necessary apparatus, etc., for pulverizing mercury bi-chloride.

Liberty and Constitution.

MEXICO, September 1, 1892. ROMERO RUBIO.

II.

The president of the Republic, by and in consideration of the powers entrusted to the executive, as by decree dated December 16, 1891, and by and with the advice of the Superior Sanitary Council, has deemed convenient that from the date of these presents and till otherwise ordered, the following dispositions be set in force:

1. News having been confirmed that cholera has broken out in the United States of the North, the transit of passengers from that country to the territory of this Republic will only be allowed through the following places: Matamoras, Nuevo Laredo, Pieday Negras, Paso del Norte, Nogales, and Tijuna, in which places a sanitary station will be established and where passengers will be detained at present, for the time necessary for the sanitary inspection to be made and the disinfection of clothing and baggage, as also of all *susceptible* merchandise. This department, when it deems the proper time has come, and the Superior Sanitary Council consults, it will advise its agents by telegraph to prolong for twenty-four hours the detention of the passengers so that they may be in observation during that time.

2. The sanitary station will be located as far as possible from dwellings, and will have a large tent for the attendants, a hut for the disinfecting purposes, and the small tents or huts that may be necessary for the attendance of the patients.

3. If from the examination practised on the frontier boundary it appears that any or several of the passengers are attacked of confirmed cholera, premonitory diarrhœa, or any other suspicious one, they shall not be allowed to enter into our territory.

4. A certificate will be made out for those passengers in healthy conditions, after having gone through the sanitary inspection, and without this requisite they will not be admitted in any town, or any railroad train that will take them to their destination. The certificate will also refer to the protest spoken of in the following article.

5. All passengers to whom a certificate is extended, as provided for in the former article, will protest in it that they will immediately advise the authorities of their arrival at the place of their destination, and they will also advise without delay if they should be seized with cholera or choleraic diarrhœa.

6. The agents of the council at sanitary stations, referred to in article 1, will advise by telegraph to the authorities of places where passengers are bound to, giving their names, also, that they may be kept under observation for seven days.

7. All passengers arriving at this capital by railroad from the United States will be inspected. For this purpose the inspecting doctors of each ward will be entrusted with this service.

8. As a general rule no railroad train shall be allowed coming from the United States into national territory. In any case all passengers, baggage, and *susceptible* merchandise brought on board of them, after disinfecting what may be necessary, shall be changed into the national railroads. Only cars loaded with *non-susceptible* merchandise can, after the car has been disinfected, be attached to a national train, if the company they belong to so wish it; the expenses of disinfecting the cars shall be paid by the company they belong to.

9. At each sanitary station, and in conformity with the 11th article of the San-

itary Code, there will be a physician appointed by the executive, who shall be commissioned to practice the inspection of baggage and passengers and to superintend the disinfection.

10. The disinfection of clothing, baggage, and *susceptible* merchandise will be performed with sulphurous acid or burning sulphur powder in the disinfecting chamber, in proportion of 30 grammes for cubic metre of capacity, of the last substance, or, in cases when it may be necessary, with a solution of phenic acid at 5% or of bi-chloride of mercury of 1%.

11. Patients must remain perfectly isolated till the end of convalescence their dejections will always be mixed up with a solution of copper sulphur at 20% or with milky lime, and all clothing used by them while under treatment must be burned up.

12. The remains of those who die of cholera will be buried in a place set apart in the cemetery, wrapping up the remains in a sheet wet with a solution of phenic acid at 5% and filling the coffin with unslacked lime.

13. All doubts that the sanitary authorities may entertain as to the compliance with the former dispositions will be consulted by them with the Superior Sanitary Council by telegraph.

14. The infraction of any of these measures will be punished as provided by in the Sanitary Code, article 327.

And I transmit it to you, recommending, as by special request of the first magistrate of the Republic, that with the prudence, energy, and activity that the importance of the subject demands, you will contribute with all the elements of the state you so worthily govern, for the compliance of the enacted dispositions, as also those that hereafter may be enacted to prevent the invasion of cholera, and for the establishment of suitable apartments for disinfecting purposes; requesting also to all authorities and private parties, above all at frontier towns and sea-ports, to contribute for the realization and carrying out of the above mentioned disposition.

Liberty and Constitution.

ROMERO RUBIO.

MEXICO, September 19, 1892.

III.

Asiatic cholera, when it invades a country, causes the death of a great number of persons and exposes the life of so many others that its appearance has always been considered as a public calamity; its consequences, depriving children of their parents or of those who support them, snatching away children in the spring of life, and respecting neither old age nor youth, sowing everywhere mourning and desolation. Agriculture, arts, and industry suddenly lose a great number of their laborers, commerce decreases and trade lessens, and all branches become stagnant; the public revenues, at a time when their increase becomes most necessary, diminish. These series of misfortunes, the enumeration of which shows their importance, are enough to exhaust the vital strength of society and may lead to poverty, nay to misery.

It would be useless and inhuman to afflict people with an account of these evils if they were unavoidable; but fortunately they are not. Cholera is a disease that is transmitted through contagion from diseased parties to healthy ones mainly by their dejections, by the clothing soiled by them, by contact with contaminated

objects. The mixing of the germs in drinking water and that used for domestic purposes is one of the most efficient means of contamination; the dust containing the germs scattering about the air, surrounds the patient with an infectious atmosphere, and all the portions of it that may attach to interstices of clothing or any objects near them may become as many vehicles for the propagation of the disease. The discovery of comma-bacillus having made us acquainted with the generating germs of the disease, has afforded us the explanation of the facts we have just mentioned, and the studies undertaken about the existence of this microbion, its vital resistance, and the substances that can destroy it, will come in aid to clear up all the yet dark points in the etiology and generation of the disease.

In the history of this micro-organism we must bear in mind some points that may have a practical application; up to date the formation of spores or lasting form of this microbion has not been observed.

The comma-bacilli are not very resistant; they die if submitted to a higher temperature than 50° in a middle acid, as gastric juice. Dessication kills them off rapidly, For their development they need much oxygen, but on the other hand they can live for many months in a damp atmosphere and in any medium appropriate for their culture.

They thrive very well in milk; in sterilized water they swarm about the first days, and afterwards remain motionless for whole months; in unsterilized water the other microbions destroy them easily; however, Koch has found them alive in the impure waters of the tanks in India. All these circumstances must be borne in mind to proceed reasonably in the application of disinfectants.

In the meantime, knowledge has shown these two facts: that isolating the diseased is an efficacious means of avoiding the propagation of the disease; and that the destruction of the germs by means of chemical or physical agents is also an efficacious one. The first of these is accomplished by means of special hospitals, lazarettos, and the quarantine to which vessels are submitted, at the ports; the second is accomplished by means of the resources that modern science has placed at the disposal of disinfection.

The first of these resources prevents communication between diseased persons and those in health, and relies for its efficacy on the spontaneous destruction of the germs by the action of time or at least the lessening of their virulence.

The second tends to destroy *in situ* the germs of the disease.

As this second resource becomes more perfect, the first one will lose more of its importance, and thus, we can conceive the possibility of the disappearance of quarantines when disinfection possesses for each disease a physical or chemical resource capable of destroying the germ that originated it.

If our sanitary delegates at the ports become persuaded of the truth of these assertions, they will understand the reasons why the council had to consult with the Executive of the Union, as to the preventative measures against cholera, that are attached to this circular; but it will at the same time convince them that on shortening the length of quarantine it is in the belief that they have all the absolute possible means to perfect the execution of disinfection.

The council hopes that in a not very far off day each of our ports will be furnished with a disinfecting stove, as also with all the necessary elements to perform the operation with the perfection that science points to; but undoubtedly the corporations at each port will furnish them at once with a closed-up room that

can be used for disinfecting by means of sulphurous acid, and portable apparatus to perform it by means of solution of bi-chloride of mercury.

The former considerations will convince the delegates of the immense responsibility they assume from the time that the nation trusts to their patriotism, intelligence, and zeal the care of preventing through our ports the introducing of cholera in our republic.

Therefore, you are particularly requested to execute the following instructions:

The inspection of crews and passengers must be rigorously made so as to ascertain that no cases of cholera are aboard; second, that there is no choleraic diarrhœa, and in the third place that none on board are convalescent of the disease.

It will be necessary to inquire with the greatest care, if there has been any patient, in which department he was; with whom and what objects he came in contact; if any of the furniture or portions of the ship were soiled with his dejections, and finally to investigate where are the clothes worn by the diseased. The most careful disinfection must be made on those clothes, furniture, and parts of the ship that have been contaminated, as well as the clothing of the parties that came in contact with the patient.

All those quarters of the ship where any patients have been, will be disinfected by means of sulphur and bi-chloride of mercury, according to the peculiar construction of the departments where the disease appeared.

The water-closets shall in all cases be disinfected by means of a solution of phenicated acid at 5% mixed with sulphur of iron.

Only the baggage in the cabins and in the holds of the vessel that has been handled by diseased passengers will be disinfected, or those that are more susceptible of importing the contagion.

The disinfecting of dejections and places soiled by them will be made by means of sulphur of copper at 2° or of milky lime, and clothing so soiled will be boiled in a solution of sulphur of zinc. As the disinfection of baled rags is extremely difficult, and is furthermore very dangerous, great attention must be paid that no package is shipped into the country, that they are not moved out of their place, so they may be returned to the port of shipment, or if the captain or master of the vessel consents to it, all bales of rags shall be destroyed by fire.

To prepare milky lime, a good quality of lime should be used, and this is to be diluted by sprinkling it gradually with about half its weight of water. Care should be taken to perform the operation slowly, for if it is done in a hurry, the lime will be "extinguished" and not diluted. When the deliquescence has taken place the powder obtained must be put in a receptacle, carefully covered, and preserved in a dry place, and deprived of carbonic acid; cellars are therefore not convenient places. The milk is prepared when it is about to be employed. To 1 kilogram of lime that has absorbed 500 grams of water to dilute it, it obtains a volume of 2 litres 200; it is enough to dilute that amount of hydrate of lime in double its volume of water, or be it 4 litres 400, to have a lime milk of about 20%.

And by order of the council I transmit it to you for its compliance, enclosing the circular of the department dated 1st inst., that points out the measures referred to, hoping you will please duly acknowledge receipt.

Liberty and Constitution.

E. Licéaga, *The President of the Council.*

Mexico, September 5, 1892.

IV.

The following instructions transmitted to sanitary agents at the frontier were addressed to them with the same exposition embodied in that transmitted to the delegates at seaports:

In accordance with articles 32 and 33 of the Sanitary Code, the land quarantines will consist of sanitary cordons situated in those places of the frontier named in the enclosed circular of the Department of the Interior dated 19th inst.

As soon as the agents arrive at sanitary stations where they have to fulfil the duties entrusted to them, they shall inspect the place, so as to choose the most suitable locality for its establishment, bearing in mind that the soil be dry, on a natural declivity or being canalized; that waste water can run off to a distant place where it cannot taint the drinking water or that used for domestic purposes or run through settlements. As provided for, a tent or hut will be set up for inspecting in it the conductors and passengers of the trains, as well as travellers that come by the railroads.

An apartment for performing in it the disinfection.

Another tent or hut for those attacked by choleraic diarrhœa, and that can not return to the United States.

A hut to put baths in and if it is possible, to have the same built in the conditions hereafter mentioned.

These departments must be conveniently separated, the ones from the others, attending to the quarter the wind blows from and being careful that choleraic patients and those with choleraic diarrhœa be isolated, the ones from the others, as likewise from the other departments.

The agent will choose, at a convenient distance, the ground for the encampment of the military force that is to impede, as a sanitary cordon, the transit of passengers and merchandise from the American frontier to ours and also to enforce all measures adopted by the agent.

The agent will also select a place for the burying of the dejections of patients that must be immediately disinfected as soon as emitted. These dejections must be buried at a good depth and with layers of unslaked lime.

If on the location selected there are already any rooms of mortar, "adobes," or timber, these can be made available by and with the consent of the local authorities and indemnification to the owners, if said tenements are in the conditions above stated.

If there are no buildings, tents, cars, and wagons that are not in active use on railroad stations may be taken, but if these are not available, timber huts must be erected, bearing in mind the conditions that science teaches us that those provisional and temporary erections should have.

The hut used as an office will be furnished with the indispensable tables, chairs, etc.

The symptoms of part of the digestive apparatus will form the main questions of the interrogatory.

If from the above-mentioned examination it is found that a party is sick of cholera, he shall not be allowed to enter into our territory. If he is only suspected to be sick, he shall be conveyed to the hospital hut. His clothing will then be inspected, that found in a dirty condition will be tied up in a bundle to

which a numbered ticket shall be attached, giving the party a duplicate of the number, and the bundle shall be sent to the disinfecting department.

If the passengers are in a healthy condition they will be furnished with a passport as provided for in the above mentioned circular.

Bed clothing will also be classified among *susceptible goods*, as in the circular referred to, and as such, shall be in all cases subjected to disinfection.

The room used for the stove must be in such condition that it can be hermetically closed when disinfection is made by means of sulphur.

The persons engaged in disinfecting will be detailed from the army ambulances, by, and with the authorization of, the secretary of war.

Parties engaged in disinfecting are to be provided with convenient apparatus to avoid being infected; they will be furnished with an impermeable suit that can be disinfected; they must wash their hands in a solution of phenic acid, and afterwards in clean water.

The corporation of the locality will be requested to furnish the provisional hospitals with the bedsteads, mattresses, pillows, sheets, shirts or nightgowns for the patients, a small table set, chamber, vessels, and spittoons and all other things that may be required for the attendance of five choleraic patients and five other of diarrhœa cases, to be increased if the requirements of the service make it necessary; corporation to bear the expense out of its funds or the amounts collected from the citizens for said purpose.

The bath, if it is possible, is to be located in a closed-up room or timber hut, the premises to be provided with small compartments (so that each passenger can leave in one of them his clothes, while bathing) and a large space for bathing, properly speaking, provided with a shower bath (that should not be a pressure one) that will pour out a shower of tepid water on the bather, who shall have quickly soaped himself. This system enables many baths to be given in quick succession. Barrels in a good condition or the small iron tanks belonging to the railroads, if they are not using them, will serve the purpose of tanks.

When the sanitary station has been located the agent will forward to the council a sketch of the installation and its position as to the nearest frontier town.

The agent will forward to the sanitary authorities, if there are any, or the civil ones of the other side of the frontier, a copy of the measures approved by the Department of the Interior.

Disinfecting apparatus, with which solution of bi-chloride of mercury is to be applied, are all those that throw, to a certain distance, water in a pulverized state; they may be like the Lister model that are used to make a spray, or like the aspiring and impelling pumps, garden pumps, small hand fire pumps, (but furnished with a fine terminal watering sprout) or any other similar ones that may be brought from the United States; and the models or drawings of which will be forwarded by the council.

Correspondence, though it comes from an infected locality, need not be disinfected.

When sulphurous acid, or water steam under pressure, be applied for disinfecting purposes, baggage can be disinfected in bulk. But if disinfecting solutions are employed, baggage must be disinfected in detail.

The disinfecting of merchandise will be applied to only the kinds classified as

susceptible, as unmanufactured wool, goods manufactured with that fibre that are not in packages, feathers, horse-hair, and in general, animal remains.

The sanitary agents will not only report by telegraph as provided for, but will forward to the council a daily report of all events.

The council trusts that you will zealously enforce all the measures provided for, by the Interior Department under date of the 19th inst., because it relies that the strict compliance of said measures will prevent the invasion of the epidemic through the sanitary station intrusted to your care.

E. Licéaga,
The President of the Council.

Mexico, September, 1892.

XXXVIII.

THE DISPOSAL OF GARBAGE IN THE CITY OF PROVIDENCE, RHODE ISLAND.

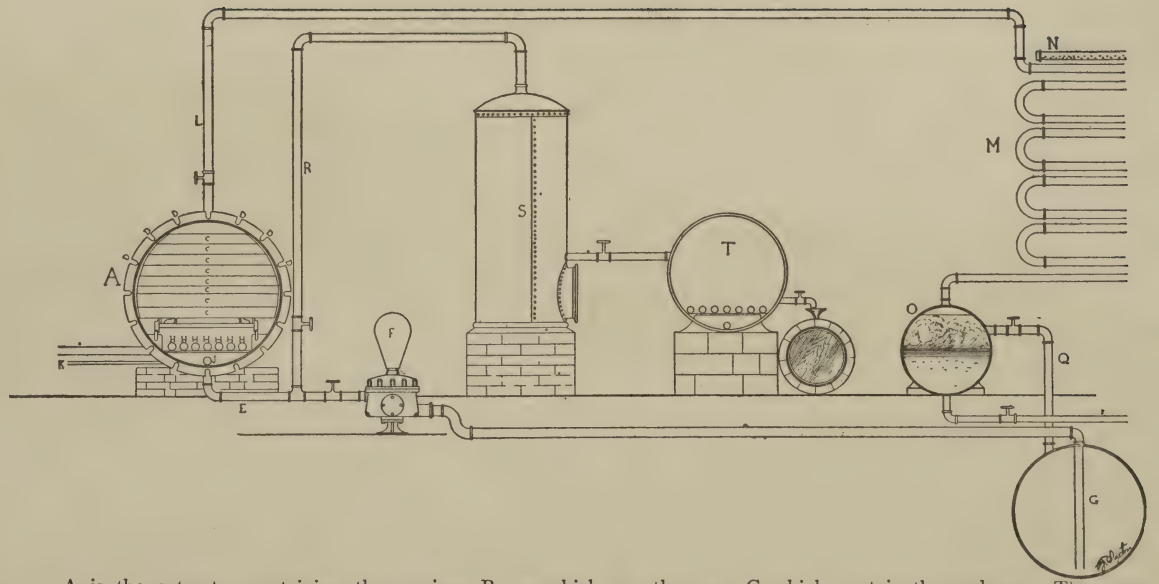
By CHARLES V. CHAPIN, M. D.,

Superintendent of Health,

Providence, R. I., U. S. A.

The swill or house garbage of Providence is collected and disposed of by contract. The present contract is for five years from May 1, 1889. The contractors receive 15½ cents per annum for each inhabitant, and they are for this amount to collect and dispose of the garbage. At the present time the population of the city is estimated at 139,000, and they therefore receive $21,545 per annum. When the contract was entered into, the contractors expected to dispose of the garbage by delivering it F. O. B. on the cars in the city to a hog-grower, who owned an extensive piggery some distance out in the country, and who had agreed to receive the garbage and pay the expense of transportation. The contract price therefore was estimated to give merely a small margin of profit over the cost of collecting alone, as the disposal was supposed to cost the contractors nothing. After the contract with the city was signed, the arrangement with the piggery people fell through, and the contractors were obliged to seek some other method of disposal. As a result a stock-company was formed and a process adopted for disposal by means of naphtha. Arrangements were made with I. M. Simonin, of Philadelphia, who had for many years been conducting the business of extracting grease and oil from various waste products by means of naphtha. Works were constructed near the center of the city in accordance with plans furnished by him. There is in Providence a large area of swampy land, recently filled in, almost in the center of the city. It was on this land, quite a distance from all buildings except two or three large manufactories, that the garbage works were established.

The use of naphtha for the extraction of fats and oils on a large scale is not a new art. It has been employed by a number of large firms in this country for many years. It was first applied to the utilization of garbage, I believe, by the Baynes Garbage Company, of Buffalo, New York, operating under the patents of the Merz Company of that city. By the Merz process the garbage is first dried as completely as possible in closed, steam-jacketed driers, the moisture being driven off, condensed, and discharged into the sewer or river. The dried garbage, or "tankage," as it is technically called, is then treated with hot, liquid



A is the extractor containing the carriage B, on which are the pans C which contain the garbage. The cover is fastened in front by means of swinging bolts which fit into slots D. The extractor is filled with naphtha through the pipe E, the naphtha being drawn by the pump F from the holder G. The naphtha is heated by the coil H which is filled with steam through the pipe I. The open-steaming is done through the perforated pipe J, which is filled with live steam through the pipe K. During the process of evaporation the naphtha and water vapor pass through the pipe L to the condenser M, which is cooled by water dropping from the pipe N. The condensed water naphtha vapor flows into the separator O from which the water passes to the sewer through the pipe P, and the naphtha to the reservoir through the pipe Q. The grease which is extracted from the garbage is forced through the pipe R to the settling tank S, from which it passes to the still T, in which it is finally separated from the remnants of naphtha which it contains and from which it is drawn into barrels for shipment. The still is provided with heating coils and open-steam pipes similar to those in the extractor.

naphtha, which percolates through it and dissolves the grease. It is impossible to thus extract the grease unless the garbage has been thoroughly dried. The drying of the garbage by steam heat, which is necessary under the Merz patents, is an expensive operation. The Providence company at first experimented with the Anderson drier, which is constructed on an entirely different principle from the one used by the Merz people and is continuous in its operation and very economical. It failed, however, to dry the garbage, and hence was abandoned. Garbage contains so many different ingredients and so much grease that it is one of the most difficult substances to dry. The finer portions would come out of the Anderson drier in a very satisfactory condition, but larger masses, like potatoes and apples, were almost unaffected. It is necessary that the whole mass should be finely pulverized so as to become homogeneous and to be subjected to a high temperature for many hours in order to remove all the moisture.

Another experiment was tried by the Providence company for removing moisture. A press was set up, but it was soon discovered that the most powerful hydraulic pressure could not remove much more water than would drain from a pile of garbage in a few hours when merely left upon the floor or in a bin. The failure of the press was also due to the lack of homogeneity in the garbage. If it could be ground before pressing, much more liquid could be squeezed out; but grinding garbage is a very difficult operation and moreover would complicate the process too much. Thus from repeated trials it was found that from an economic as well as from a sanitary standpoint, pressing and drying garbage in the ordinary way were impracticable.

By the process finally adopted and now in operation, the garbage is dried and the grease removed at one and the same time, by treating it in a closed receptacle to the action of hot naphtha and naphtha vapor.

In Providence the owners or occupants are required to dispose of ashes and all other refuse, except garbage, at their own expense. The garbage, separated from everything else, is kept in tubs or barrels in the yard and is called for by the contractors three times a week during the summer and twice a week during the winter, and oftener in special cases when required by the health officer. The separation of garbage in this way is very thoroughly carried out, and it is only exceptionally that it is mixed with ashes. The contractors use for the collection 16 two-horse carts. These carts are constructed of wood, are water-tight, with covers, and are of the following dimensions: width, 3 ft. 8 in., length, 11 ft. 5 in., depth, 2 ft. 6 in., and weigh about 3,300 pounds. The weight of a wagon-load of garbage is on an average about two tons. A considerable portion of this weight is due to water, and when the garbage has been left to drain for a few hours it is found to diminish about 50 per cent. in weight though it does not diminish very much in bulk. The garbage, immediately after its collection, is carried to the disposal works previously referred to, near the center of the city, which are operated by Mr. I. M. Simonin, to whom the contractors deliver the garbage.

The garbage is here unloaded upon a concrete floor, where it is allowed to drain of superfluous water, which runs into a river that flows close by. The amount of the liquid is of course in the aggregate not very large, and could be without offense discharged into a small stream or a well-constructed sewer. After it has been allowed to stand here for a few hours, it is loaded into carriages which are at once rolled into the extractors. The carriages carry a series of trays made of sheet-iron and coarse wire netting, so that the garbage is spread in layers about six inches in thickness. This is to prevent the matting together of the garbage, which would result from the pressure of its own weight if it were loaded into the extractor in bulk. The carriages with their trays are made of such a form that they fill the extractors as completely as possible, so that the naphtha will be forced to pass through the interstices of the garbage rather than around the sides of the mass. The extractors are wrought-iron tanks six feet in diameter and eighteen feet long, and calculated to stand a considerable internal pressure. The extractors are placed horizontally, and one head is removable, being lifted off by a tackle from above, and made tight when in place by screw-bolts around the rim. When loaded, an extractor contains about eight tons of garbage as it comes from the floor. The head of the extractor is then screwed on and the extractor pumped full of hot naphtha. In the bottom of the extractor is a closed coil of steam pipe. The steam is now turned into this and the naphtha vaporized. The hot naphtha vapor as it passes up through the garbage takes up the water vapor, just as hot air would do under the same circumstances. The mixed naphtha and water vapor is led off from the top of the extractor to a condenser formed by a coil of pipe over which cold water is kept flowing. The condensed water and naphtha pass to the "separator," where they separate in two layers, the naphtha floating on top. The naphtha is drawn off continuously to the naphtha tanks and the water passes off into the river, or could well be discharged into the sewer if there was one. From the naphtha tanks the naphtha is pumped directly to the extractors again, passing through a heater on its way. This heater is so arranged as to heat the cold naphtha by means of the hot naphtha vapor which comes from the extractors, thus forming a sort of secondary condenser and economising both the heating of the naphtha and the cooling of the naphtha vapor. As the naphtha in the extractor is brought in contact with the garbage it dissolves out some of the grease. The naphtha vapor also, as it passes through the garbage, dissolves out the grease, which trickles down into the liquid beneath. As the evaporation continues, the level of the liquid in the extractor sinks lower and lower. It is a solution of grease and naphtha, which is constantly becoming more and more concentrated. When it is evaporated so that there is only a small amount in the bottom of the extractor, not reaching the level of the bottom of the carriages containing the garbage, it is forced off into the "settler." The extractor is then filled with naphtha again and the process repeated seven or eight times, until all the grease and water are removed. Open steam is then

turned into the extractor and allowed to pass through the garbage for three or four hours, until every vestige of the naphtha is removed. This steam also, after leaving the extractor, passes through the condenser, so that every portion of naphtha that it removes from the garbage is saved. The evaporation of a charge of naphtha occupies about four hours, open steaming about the same, so that the whole time occupied in extracting the garbage is thirty-two to thirty-six hours. After the open steaming, the head of the extractor is removed and the charge drawn out and carried to another building, where the dried garbage is ground, sifted, and bagged, ready to ship to fertilizer manufacturers. The amount of dried garbage, or tankage, which is obtained from an extractor varies somewhat at different seasons of the year, but averages about a ton and a half. To return to the settler: this is a tall, upright, iron tank which receives the solution of grease and naphtha from the extractors and also a certain amount of water and dirt which comes with it. This latter is drawn out from the bottom and passes into the river, while the naphtha solution goes into the stills where the naphtha is driven off by distillation and open steaming, and the grease is then drawn off and is ready for shipment. The amount of grease also varies with the seasons, but will average about six hundred pounds to an extractor.

The works in Providence consist of a building in which are three boilers aggregating about 235 horse-power; here is also the engine and the grinding mill and the store-room for the tankage. Attached to this building is a shed where the garbage is unloaded from the teams and put on the carriages. The building where the naphtha process is conducted is entirely separate from this building, and is merely a frame covered with corrugated iron. In it are six extractors, two settlers, two stills, and the necessary pumps, tanks, and piping. The condensing apparatus is outside, in order to get the advantage of cold air. The water for condensing is supplied by a large steam-pump, which is connected with four driven wells supplying about 250,000 gallons every twenty-four hours, at a temperature of 50 degrees, which is uniform throughout the year. The tanks for storing the naphtha are also in the open air. The works are run day and night with the exception of Sunday. The quantity of coal consumed is about forty-eight tons per week, or a little over two tons for each extractor full of garbage treated; therefore one ton of coal evaporates about three tons of water. There is a loss of naphtha in various ways, by leakage and evaporation, amounting to nearly 1,000 gallons a week.

The amount, value, and composition of garbage varies very greatly at different seasons of the year. The bulk is the largest in the summer, beginning to increase with the beginning of pea-pod time and reaching its maximum during the height of the green-corn season, at which time the total volume of the garbage is fifty per cent. greater than it is at the minimum. The smallest quantity is in spring and fall. Vegetable material in garbage has little value as a fertilizer or for grease. In the winter time the bulk and weight of the garbage is, in the climate of Prov-

idence, increased considerably by snow and ice. The amount of garbage collected during the year is about 15,000 tons as it stands in the carts. As has been stated, about fifty per cent. of this drains out on the floor. Of the remainder, from seventy-five to eighty per cent. is water, from three to six per cent. grease, and the remainder—from fourteen to twenty-two per cent.—dry residue or tankage. The grease is very dark in color and can be used for any purpose for which dark grease is adapted. The tankage shows on analysis from five to twenty per cent. bone phosphate, from three to six per cent. ammonia, and a little over one per cent. potash. It is exceedingly dry, and is in great demand by fertilizer manufacturers for mixing with other ingredients.

There has been considerable complaint in regard to the nuisance caused by the works for the disposal of garbage just described. A part of this undoubtedly has some foundation in fact. The garbage as it drains upon the floor is undoubtedly a nuisance, though the smell from this is somewhat confined by the building and does not travel very far. In the construction of new works pockets would be provided similar to those used for grain or coal, in which the garbage would be at once received and tightly covered. If necessary these pockets could be ventilated under the fires. The other source of nuisance is from the leakage of naphtha vapor. As the naphtha is used over and over again it becomes saturated with odors derived from the garbage, and being very volatile, whenever a leak occurs the vapor is carried to a considerable distance. This source of nuisance I think could also be removed by having a different kind of condenser which would not leak.

XXXIX.

SOME CONSIDERATIONS ON PARASITISM IN YELLOW-FEVER.

By Dr. M. CARMONA Y VALLE,

Mexico.

But the present status of bacteriology makes it also evident that great care must be taken in determining the identity of micro-organisms from different sources, and that morphological character or even similarity of growth in culture media will not alone suffice. Any constant difference in physiological character, as for example in pathogenic power when tested on various animals, must be accepted as establishing a specific form, or a permanent variety, which amounts to the same thing. We now know, for example, two spirilla which resemble closely the spirillum of Asiatic cholera (the Trinkler Prior spirillum and the "cheese spirillum" of Deneke), but which have, nevertheless, been shown by careful experiments to be different in certain particulars which would easily escape notice upon a superficial comparison. *Sternberg's report on etiology and prevention of yellow-fever.*

To investigate if a disease is or not a parasitical one we must follow the road traced for us by experimental science. Bearing in mind the rules of the severest antiseptics, we must determine, in all the liquids and solids of the organism, whether there exists any well defined microbion, or not; and if the results are affirmative we must afterwards proceed to introduce it into the animal economy and see if it reproduces the morbous entity that we have under study.

It is only when we have conscientiously fulfilled all these conditions, and the result has been affirmative, that we know that such a disease is parasitical.

For the disease of yellow-fever, this road has been very skilfully followed by my good friend, Doctor Sternberg. With all his science, and conscientiously, he has carefully searched for some micro-organism in the liquids (or most of them) and solids of the yellow-fever patients. His great practice in this kind of labor, and his profound knowledge of bacteriology, have not been sufficient to discover in yellow-fever any micro-organism with special characteristics to distinguish it from those already known.

Could we, on this account, logically deduce that yellow-fever is not parasitical? Certainly, gentlemen, that conclusion would not be a logical one, because it might well happen that a micro-organism of that morbous entity had a great similarity with those already known, as well in its physical characteristics as in its development through the different stages of its culture. Bacteriological science is still in its infancy, and

we have sufficient examples of pathogenic microbia which bear a great resemblance to others that are not identical; the failure of pathogenic action in economy of man or beast, after the introduction of a micro-organism, is not conclusive, since science is still ignorant of the different ways in which a microbion, or its offspring, may introduce itself in our organism, so as to bring about this or that morbous state. Furthermore, in a certain period of its development a micro-organism may be pathogenous, while in other stages it may not be so. These are very important problems that have not been solved yet, and that we must bear in mind in a case like the one we have under consideration.

Therefore, as the proceedings so skilfully carried through by Doctor Sternberg have been really scientific proceedings, the results, had they been positive, would have decidedly led to the discovery of parasitism in yellow-fever; but as those results have been negative, we must remain in doubt, and carry on our investigations along other lines. How many times a winding and narrow path leads us more easily to the end of our journey when the wide and straight highway is strewn with difficulties!

When we have a patient under observation, and we find that his spittle contains the bacillus of Koch, we can feel certain that our patient has tuberculosis, but if the result is a negative one, then we doubt, and carefully search if by some other means we cannot arrive at the diagnosis.

Thus, then, gentlemen, allow me, leaving on one side the highway travelled so skilfully by Doctor Sternberg and following a more devious path, to strive to reach the object that we purpose. The subject is of such vast importance for humanity that it well deserves that all observers shall contribute their mite to it, so that those who may come after us, may gather from here and there data that may lead them to the solution of the problem.

I wish that we should at once fix our attention to a symptom so peculiar to black-vomit that by itself it has been enough to distinguish this pyrexia from many others, to such a degree that in all languages it has been called yellow-fever. The importance of this phenomenon that thus characterizes this morbous state, must therefore be of such importance that the discovery of its generating cause, must aid a great deal in finding out the genesis of the same disease.

This is why I have laid so much stress on the study of this symptom, and the results of my investigations I have published in my "Clinical Lessons on the Ætiology and Prophylaxis of Yellow-fever." In said work I have committed certainly a great error in that part that refers to the morphology and classification of pathogenous-organisms. This error is due to the limited development that, at the time of my publishing said work, bacteriological studies had acquired in Mexico; but, leaving aside this question, there are many other phases from which knowledge may be gained that I have wished to have seen studied by other observers. Among them, the one relating to the cause of yellow hue in black-vomit patients.

Everybody knows that the majority of authors attribute this discoloration to a biliary icteric, while I, without denying that in some cases, above all during convalescence, there is a true biliary icteric, still hold that the discoloration is due to the presence in the organism of a particular substance that I call "icteroidina."

It is very easy to be convinced that the yellow tint is not due to the presence of bile in the blood. For this we have but to examine the urine with the ordinary reagents to know that there are a great many yellow sick persons in whose urine reagents do not show any vestiges of bilious coloring matter. On the other hand, if by means of acetate of lead we decompose a bilious urine, however dyed it may be, we will after filtration obtain a completely colorless liquid. On the contrary, the urine of a patient yellowed by the vomit, submitted to the same experiment, will always leave a straw-yellow liquid that will never become colorless.

The coloring principle of this liquid is what I call "icteroidine," and the manner of obtaining it is very easy. First, the urine must be decomposed by precipitation by acetate of lead, but taking care not to use too much of this salt; in the second place the precipitate must be carefully washed, and lastly, a current of carbonic acid must be made to pass through it, so as to decompose the acetate of lead which may have remained in the liquid; after filtering it again and washing the precipitate, it must be left to spontaneous evaporation, and thus we shall obtain a substance of the consistency of thick honey and of a yellow color, insoluble in alcohol, in sulphuric ether, or in chloroform, but very soluble in water, to which it imparts a straw-yellow tinge very much like that of vomit patients.

I have the honor to present to you a specimen of this substance that I obtained, by means of the process indicated, from about 200 grammes of the urine of a patient who had reached the period of yellowish discoloration. In that specimen you can test the properties that I have stated.

I am not acquainted with any substance in the organism that is like "icteroidine," and if this is matter foreign to the economy, where does it come from?

This is, therefore, the great question, the clearing up of which will throw great light upon the pathogeny of yellow-fever, and so far as I am concerned I wish to announce here what I have been enabled to observe on this point, and which all the medical world can verify whenever they wish.

In the urine of our patients there is developed, in that disease as in any other, a great quantity of micro-organisms; but among the others there is in the urine from yellow-fever one that after thorough analysis is the most abundant. Spherical or slightly oval-shaped, it is from a half to one micro in size; slightly yellowish in color, it is endowed, when in water, with rapid undulatory movements. If to the watery liquid in which they move we add alcohol in a sufficient quantity, we observe that all of them then conglomerate, and form large yellowish masses; in chloroform and

ether they congregate in the same manner, and lose their movements. If they are placed in a watery solution of hematoxylin they congregate in the same manner, and lose nearly all their movements. This last phenomenon is not to be observed in any other organisms developed in the urine, except in those from yellow-fever patients.

Now if from the decomposed urine these microbia are taken out, and deposited in a solution of a potash salt, above all, if this should be cyanide of potasium, we will find the next day that many of these micro-organisms have grown, little by little, till they have acquired relatively colossal proportions, and it is a very curious sight, to see from the tiniest microbia, a succession not interrupted of different sizes up from small spheres to the most voluminous, all filled with an oily liquid of a yellow color slightly reddish, very much resembling the "icteroidine."

The undulatory motion becomes less marked as they grow, and when the vases reach certain dimensions they break open and allow their contents to escape into the water, and the empty bags remain swimming on the liquid.

I wish to call attention to certain facts that may aid in demonstrating that the liquid contained in these microbia is the same "icteroidine" that we have met with in the urine. In the first place, the physical appearance of these contents and that of "icteroidine" is entirely the same; in the second place, "icteroidine" is completely soluble in water, and in that liquid the microbia live and move about with perfect freedom; in the third place, alcohol, ether, and chloroform do not dissolve the "icteroidine," and it is in these very same liquids that the micro-organisms lose their movements and congregate in large masses, as if it were in this manner that the individuals so placed on the surface, and in contact with a liquid unsuitable for their physiological changes, protect those in the centre from contact with the noxious fluid.

In other liquids of the economy, and even in the matters vomited, thick vesicles filled with "icteroidine" are to be found, and these have been supposed to be, by some of my learned companions, small drops of grease; but I have shown them their mistake, proving to them that these can be dissolved neither in alcohol nor in ether. I call attention to this fact because it goes to show that the micro-organism is not accidental in the urine, but that it becomes general in all the economy.

If we thus explain the yellow hue in the patients of vomit, it will then be very easy to account for the fact that for so long a time has attracted the attention of observers, that is, that the yellow becomes more intense even after the death of the patient and when all vital phenomena have disappeared. The micro-organism, which does not die with the patient, continues developing at the expense of the liquids, and increases in proportion to the amount of "icteroidine," and necessarily increases likewise the intensity of color.

If this premise is admitted, I then argue in the following manner: In black-vomit the yellow coloring of the patients is so marked a phenomenon, and gives such a characteristic to the disease, that in every language

it has been called yellow-fever. Now this hue is due to the product of the micro-organism, then this micro-organism has much to do with the pathogeny of yellow-fever.

The demonstration of the presence of this germ in the thickness itself of the tissues has been up to now impossible, and the reason of it can be easily understood. Its dimensions are so small that except by means of the yellow color it would be impossible to distinguish it among the constituent elements of the organs. Now, as its affinities with coloring substances are so weak, I have been unable, so far, to do with it what is daily accomplished with the bacillus of tuberculosis. In its growing period, to form the "icteroidine," its dimensions are much larger, but in that stage it has so great a resemblance to small drops of grease that, perhaps on this account, all authors speak of the greasy degeneration of the organs in yellow-fever.

Surrounded by so many difficulties we find, however, in this microbion a property that is going to aid in demonstrating its presence in the blood of the diseased, at least in the blood of the hepatic system. I have before made known the properties that this micro-organism has, of forming large conglomerations when it is placed in contact with alcohol or other liquids. If this phenomenon is observed with a microscope, we notice that one or several blocks are formed, but that hardly any microbia remain isolated. Furthermore, in the various manipulations for preserving, hardening, coloring, drying, etc., the cuts of the microscopical preparations, alcohol is an important factor. Hence in eminently vascular organs, as the liver, and in those in which the blood contains the above mentioned microbia, such conglomerations must be formed, and these scattered in different points of the conduit of the vases, are found in some of the cuts, and then they become very perceptible under microscopical examination.

This is just what takes place, as is proved by the preparations of which I have spoken before in my "Lessons of Ætiology and Prophylaxia of Yellow-fever," which have been prepared at different times, from different patients, and by different parties, the result always being the same. These conglomerations are always shut up in hepatic vases, and they are sometimes so robust that they have been seen by the naked eye, as yellow spots contrasting with the red color of the cuts that have been dyed with pyrocarmine. The small affinity that these organisms have with coloring matter is such that, forming so large masses, their yellow color contrasts with the hue given to the rest of the preparation, and on account of this property it well deserves as a distinctive the Latin adjective *luteus*, *lutea*, *luteum*. In ocular No. 2 and Zeiss objective D. or E., we see that these large blocks fill all the calibre, or a part of it, in the hepatic vases, that its aspect is granulous and its color yellow, more or less clean according to the coloring principle that has been used to dye the block. Using stronger amplifications (ocular No. 5 and objective ½ of homogeneous immersion), and looking out on the limits of the block for those points in which the conglomeration is not so thick, we can make

out that it is formed by the reunion of an immense amount of exceedingly small granulations of a spherical or slightly oval shape entirely alike, those micro-organisms that growing and developing themselves form spherical sacks filled of "icteroidine;" and in order that this conviction may grow stronger, one can see in some of the preparations the large sac empty and mixing with the small microbia on the block.

Thus, then, in the hepatic vases are found the large conglomerations which we have seen forming in the residuum of the urine by the action of alcohol; one can see that they are formed by organisms of the same dimensions and same form, that they maintain in mass the yellowish color that predominates in yellow-fever, and finally the empty sacs can be seen to be no other things than the hydropic microbia that have allowed their "icteroidine" to escape.

All this can be observed in the preparations which I have the honor of presenting to you, and can be easily studied in the urine of black-vomit patients. I do not wish to give up this matter without indicating in a most decisive manner, that it is not to be expected that one find a conglomeration of these in every cut that is made in the hepatic parenchyma. On the contrary, the cuts where nothing is to be found, are much more numerous than those where the microbes can be seen. The reason of this is very simple if we bear in mind what I have stated previously. By the action of alcohol and many other agents, all the microbia disseminated in water, or any other liquid in which those small beings can live, are congregated in one or several groups and when once the blocks have been formed they float on the liquid and separate at quite a distance the one from the other. For this reason it may happen that many of the cuts of the liver may fall between any two blocks and therefore the vases may be found empty; but when the cut falls on one or several of the conglomerations, then they can be observed, as those which I present you in my preparation.

If any doubt remains in your mind about the nature of these conglomerations, I can assure you on my word of honor that, a short time after those preparations had been made, I found it very easy on dismounting one of them and placing it in water to see thousands of these micro-organisms separate, endowed with the same movements as those I found in the residuum of urine. Furthermore, having devoted myself for many years to the study of certain hepatic scirrhi I have been enabled to study a great number of preparations of the liver and only in yellow-fever have I found the above mentioned blocks.

In 1886 I sent to Veracruz, at my own expense, Doctor Matienzo, preparer of our bacteriological observatory located in our school of medicine, and that is well supplied with all necessaries. This party, who had become familiar with the preparation of the most rigorous antiseptics, was commissioned to prepare culture of blood, urine, matter vomited, and even fragments of liver and other parenchymas of the *typhus icteroides* patients. All this was performed in strict accordance with the rules prescribed in bacteriology.

The result of this study, with but few exceptions, was the obtaining in almost all the cultures the same micro-organisms and hepatic cuts, the same conglomerations that I had already found.

I wish to mention some of the results that we obtained on studying those cultures, as I think they are of interest.

1. Having boiled a culture made in broth and repeating the ebullition for five times as is performed for successive sterilizations, and inoculating with this product another sterilized broth, the result was still a positive one, showing thus that the resistance to heat of these micro-organisms is very remarkable.

2. In some of the successive cultures that were made, we could observe that this microbion perhaps presents one of those facts of polymorphism studied by Cohn and Zopf. The small spherical organisms gave place to filaments exceedingly long, that formed large entanglements and that afterwards divided and produced a species of bacillus of more or less length; afterwards these filaments went on segmenting in all their length to form again very small spheres. I have the pleasure of presenting to you a preparation of them in the same object-glass in which they are,—1st, the primitive spheres; 2d, the large filaments in which their segmentation can be traced; and 3d, the very, very small spheres like those that we have at the starting-point. This observation seems to me of importance for two reasons: first, because it can explain why some observers have believed that the germs of yellow-fever have a bacilliary form; and secondly, because, perhaps, the pathogenic power of this germ may be related with some of the described forms.

3. The third observation made with our cultures is one of the most interesting, because it can explain to us the formation of the black-vomit, which is another of the characteristic phenomena of *tyfus icteroides*. If we take a culture made in broth, and consequently containing "icteroidine," and to it we add a small quantity of bile, another of pepsine, and some drops of hydrochloric acid, we will observe that some flakes are formed, which at the beginning are of a coffee color and afterwards go on darkening in a perceptible manner. If we afterwards repeat the experiment with some simple broth, nothing analogous can be observed. Can we not see in this experiment the explanation of the black-vomit effected by the chemical reaction produced by the gastric juice and the bile on the microbia and the "icteroidine?"

Some words more about certain anatomic pathologic lesions. I place at your disposal several liver and kidney preparations in which can be seen deep alterations of the epithelio-cellular system. In the preparations made with the kidney it may be seen that many of the urinary tubes have entirely lost their epithelium and only the nuclei remain disseminated here and there. In those preparations made with the hepatic parenchyma we observe the same process; the small cellules of the organs have lost their protoplasm and only disseminated nuclei remain. This destruction of the renal epithelium and of the hepatic cellules sufficiently explain the insufficiency of the kidney and liver that is to be observed in

this disease, from whence comes the uremia and the other phenomena of general poisoning that is observed in this pyrexia.

Now, when these preparations are examined in the fresh state and under a layer of watery liquid, we can become convinced that the micro-organisms invade an hepatic or renal territory like a plague of locusts does a cultivated field: they take possession of the cellules, and do not abandon them till they have finished with its protoplasm leaving only the nuclei. It is a very curious phenomenon that may be observed by any one who will place himself in the conditions that I have referred to.

Allow me, gentlemen, to make in few words a recapitulation. A micro-organism seen in the urine of the diseased mixed with many others, we find conglomerated in the hepatic-vases. That gives us the wherefore of the yellow color in the diseased; that explains to us the formation of black-vomit, and that accounts for the anatomic pathologic alterations of the liver and kidneys, thus explaining the grave phenomena of pyrexia, and deserves from observers that they should fix some of their attention to it, and not look upon it with contempt, for the sole reason that it bears a certain resemblance to the microbia that are already known.

XL.

PROTECTIVE INOCULATIONS IN INFECTIOUS DISEASES.

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No subject connected with the prevention of infectious diseases is of more importance, from a practical point of view, than that which was assigned to this committee at the Memphis meeting (1887) of the American Public Health Association; and the delay in submitting a report has not been due to a failure on the part of the committee to recognize the importance of the task assigned to it, but partly to the pressure of other engagements and the magnitude of the subject, and partly to the fact that experimental evidence relating to the subject has been constantly accumulating during the past five years, and the fundamental question concerning the explanation of acquired immunity has not been answered in a satisfactory manner until very recently.

Before proceeding to give an account of the results of protective inoculations in the various infectious diseases in which these have been practised, we must consider at some length this question of the rationale of acquired humanity.

It has long been known that, in a considerable number of infectious diseases, a single attack, however mild, affords protection against subsequent attacks of the same disease; that in some cases this protection appears to be permanent, lasting during the life of the individual; that in others it is more or less temporary, as shown by the occurrence of a subsequent attack.

The protection afforded by a single attack not only differs in different diseases, but in the same disease varies greatly in different individuals. Thus certain individuals have been known to suffer several attacks of small-pox or of scarlet-fever, although, as a rule, a single attack is protective. Exceptional susceptibility or insusceptibility may be not only an individual but a family characteristic, or it may belong to a particular race. A remarkable example of race immunity is that of Algerian sheep against anthrax, a disease which is very fatal to other sheep. Individual susceptibility also depends to a considerable extent upon the age of the individual. Young animals are more susceptible to infection than older ones. This is illustrated in the so called "children's diseases" of man, and in the diminished susceptibility to tubercular consumption after forty years of age. It is also well established by experiments upon the lower animals, the young being susceptible to infection by "attenuated cul-

tures" of pathogenic bacteria, which older animals of the same species are able to resist.

In those diseases in which second attacks are not infrequent, as, for example, in pneumonia, in influenza, or in Asiatic cholera, it is difficult to judge from clinical experience whether a first attack exerts any protective influence. But from experiments upon the lower animals we are led to believe that a certain degree of immunity, lasting for a longer or shorter time, is afforded by an attack of pneumonia or of cholera, and probably of all infectious diseases due to bacterial parasites. In the malarial fevers, which are due to a parasite of a different class, one attack affords no protection, but rather predisposes to a subsequent attack.

The experimental evidence relating to protective inoculations in infectious diseases dates from the discovery by Jenner (1768) of the protection afforded against small-pox by vaccination with lymph taken from the vesicles of cow-pox.

In the present report we shall omit any further reference to vaccination, hoping that some other member of the committee may hereafter give such a detailed account of this particular application of protective inoculations as the practical importance of the subject demands.

To Pasteur must be accorded the credit of having first shown by the experimental method that animals may be made immune against other infectious diseases than the one mentioned by inoculations with an "attenuated virus." Commencing with his experiments upon chicken cholera, in 1880, we shall briefly trace the development of our knowledge up to the present date.

Having demonstrated that the disease of fowls known as chicken cholera is due to a specific microörganism, which he was able to cultivate in artificial media, Pasteur discovered that his cultures became "attenuated" as to their pathogenic power, when they had been kept for some time in the laboratory, and that fowls inoculated with these attenuated cultures suffered a comparatively mild and non-fatal attack of the disease, and were subsequently immune against the pathogenic action of the most virulent cultures, or against contracting the disease by contact with other fowls suffering from it.

Pasteur at once comprehended the importance of this discovery, and inferred that what was true of one infectious germ disease was likely to be true of others. Subsequent researches, by this *savant* and by other bacteriologists, have justified this anticipation; and the experimental demonstration has been made in a considerable number of similar diseases.

Pasteur first obtained an attenuated virus for his protective inoculations against chicken cholera by keeping his cultures for a considerable time freely exposed to the air, and ascribed the attenuation to the action of atmospheric oxygen. He found that when cultures were made from the blood of fowls which died from a chronic form of the disease, they possessed an exceptional virulence, which was not lost when the cultures

were renewed at short intervals, but that by keeping these cultures for two months the virulence was greatly diminished, and fowls usually recovered when inoculated with such cultures. When kept still longer, his cultures finally lost all pathogenic power. In subsequent experiments with the bacillus of anthrax, Pasteur found that the spores of this bacillus retain their virulence for years, and that it was necessary to exclude them from cultures which were to serve for protective inoculations. When cultivated at a temperature of 42° to 43° C., this bacillus does not form spores; and Pasteur ascertained that cultures kept at this temperature for eight days no longer killed susceptible animals, and could be used in his protective inoculations.

Other methods of attenuating the virulence of pathogenic bacteria have since been discovered. Thus, Toussaint has shown that exposure for a short time to a temperature a little below that which destroys the vitality of the pathogenic micro-organism, modifies the virulence of a culture so that it may serve for protective inoculations. In the case of bacillus anthracis, Chauveau has shown that a temperature of 50° C., maintained for eighteen minutes, answers the purpose.

Attenuation of virulence may also be effected by exposure to certain antiseptic agents. This was first ascertained by the writer in experiments made in 1881, the object of which was to determine the comparative value of various disinfecting agents. Incidentally the fact was brought out that agents which do not completely destroy the vitality of a pathogenic microörganism may cause an attenuation of its pathogenic virulence. In the experiments referred to, the blood of a rabbit recently dead from a form of septicæmia induced by the subcutaneous injection of my own saliva, and due to the presence of a micrococcus (micrococcus pneumoniæ crouposæ), was subjected to the action of various chemical agents, and subsequently injected into a rabbit to test the destruction of virulence. In the published report of these experiments the following statement is made:

"The most important source of error, however, and one which should be kept in view in future experiments, is the fact that a protective influence has been shown to result from the injection of virus, the virulence of which has been modified, without being entirely destroyed, by the agent used as a disinfectant."

"Sodium hyposulphite and alcohol were the chemical reagents which produced the result noted in these experiments; but it seems probable that a variety of antiseptic substances will be found to be equally effective when used in proper proportion. Subsequent experiments have shown that neither of these agents is capable of destroying the vitality of the septic micrococcus in the proportion used (one per cent. of sodium hyposulphite, or one part of ninety-five per cent. alcohol to three parts of virus), and that both have a restraining influence upon the development of this organism in culture fluids."

Similar results have since been reported by European bacteriologists. Thus, Chamberlain and Roux (1883) ascertained that the anthrax bacil-

lus could be attenuated by adding to cultures certain antiseptic agents—carbolic acid, 1 to 800; bichromate of potash, 1 to 100.

Another method of attenuating the virus of a pathogenic micro-organism is that recently (1892) discovered by Brieger, Kitasato, and Wassermann. This consists in the cultivation of pathogenic bacteria in a bouillon made from the thymus gland of a calf. It was found that the tetanus bacillus cultivated in this bouillon did not form spores, and had comparatively little virulence. Mice or rabbits inoculated with it in small doses—0.001 to 0.2 cubic centimetre for a mouse—proved to be subsequently immune. And the blood serum of an immune rabbit injected into the peritoneal cavity of a mouse—0.1 to 0.5 cubic centimetre—was found to give it immunity from the pathogenic action of a virulent culture of the tetanus bacillus. Similar results were obtained with several other pathogenic bacteria cultivated in the thymus bouillon—spirillum of cholera, bacillus of diphtheria, typhoid bacillus.

It has also been shown by the Japanese investigators, Ogata and Jashuara, that the anthrax bacillus, when cultivated in the blood of an immune animal (rat, dog, or frog), becomes attenuated as to its pathogenic power, and that such cultures, injected into a susceptible animal, give rise to a mild attack, followed by immunity. Moreover, the injection of a small amount—one drop—from a frog or a dog into a mouse, made before or after inoculating it with a virulent culture of the anthrax bacillus, was found to protect the animal from a fatal attack, and, after its recovery from the mild attack resulting from the injection, it proved to be immune. The protective influence was exercised when the blood was injected as long as seventy-two hours before the inoculation, or five hours after, and it was not lost when the blood was kept for weeks in a cool place. But subjecting it to a temperature of 45° C., for an hour, completely destroyed its power to protect inoculated mice from a fatal attack of anthrax.

Attenuation of virulence may also be effected by cultivating the anthrax bacillus in the body of a non-susceptible animal, like the frog (Lubarsch, Petruschky); or in the blood of the rat (Behring); by exposure to sunlight (Arloing); and by compressed air (Chauveau).

It is a matter of common laboratory experience that many pathogenic bacteria become more or less attenuated when cultivated for a considerable time in artificial media, even when the cultures are renewed at short intervals. This is true of the micrococcus of pneumonia, of streptococcus pyogenes, of the bacillus of diphtheria, of the spirillum of cholera, and, to some extent, of the tubercle bacillus. Indeed, as a general rule, pathogenic bacteria exhibit greater virulence when cultivated in favorable media and when recently obtained from the body of a susceptible animal; and, on the other hand, pathogenic virulence is diminished by cultivation under unfavorable conditions. Probably similar circumstances produce those differences in the type of epidemic diseases, as to malignancy or comparative mildness, which have been frequently noted; external conditions unfavorable to the development of the specific infec-

tious agent causing an attenuation of virulence, and the reverse. As pathogenic virulence depends, to a considerable extent at least, upon the formation of toxic substances during the active development of the pathogenic microörganism, we infer that diminished virulence is due to a diminished production of these toxic substances.

An important step was made in the progress of our knowledge in this field of research, when it was shown that animals may be made immune against certain infectious diseases by inoculating them with filtered cultures, containing the toxic substances just referred to, but free from the living bacteria to which they owe their origin. The first satisfactory experimental evidence of this important fact was obtained by Salmon and Smith in 1886. These bacteriologists succeeded in producing an immunity in pigeons against the pathogenic effects of the bacillus of hog cholera, which is very fatal to these birds, by inoculating them with sterilized cultures of the bacillus mentioned. Similar results were reported by Roux, in 1888, from the injection into susceptible animals of sterilized cultures of the anthrax bacillus, and also of the bacillus of symtomatic anthrax. More recently (1890) Behring and Kitasato have shown that animals may be made immune against the pathogenic action of the bacillus of tetanus or the bacillus of diphtheria by the injection of filtered, germ-free cultures of these bacilli. Similar results have been obtained by G. and F. Klemperer (1891), in experiments upon rabbits, with filtered cultures of the micrococcus of croupous pneumonia.

In Pasteur's protective inoculations against hydrophobia it is probable that the immunity which is developed after infection by the bite of a rabid animal, is due to the toxine (toxalbumin?) of this disease present in the emulsion of spinal cord which is used in these inoculations.

There is also some evidence to show that a certain degree of immunity against tuberculosis may be produced in guinea-pigs by injections of the toxic substances developed during the growth of the tubercle bacillus—Koch's tuberculin.

Evidently the facts stated have an important bearing upon the rationale of acquired immunity, and they appear to support the explanation offered by the writer in a paper published in The *American Journal of the Medical Sciences* in 1881, namely, that immunity depends upon an acquired tolerance to the toxic products of pathogenic bacteria. In the paper referred to I say,—

"The view that I am endeavoring to elucidate is, that during a non-fatal attack of one of the specific diseases, the cellular elements implicated, which do not succumb to the destructive influence of the poison, acquire a tolerance to this poison which is transmissible to their progeny, and which is the reason of the exemption which the individual enjoys from future attacks of the same disease."

In my chapter on "Bacteria in Infectious Diseases," in "Bacteria," published in the spring of 1884, but placed in the hands of the publishers in 1883, I say,—

"It may be that the true explanation of the immunity afforded by a

mild attack of an infectious germ disease is to be found in an acquired tolerance to the action of a chemical poison produced by the micro-organism, and consequent ability to bring the resources of nature to bear to restrict invasion by the parasite." In the same chapter the resources of nature supposed to be brought to bear in restricting invasion by the parasite, are referred to as follows:

"If we add a small quantity of culture-fluid containing the bacteria of putrefaction to the blood of an animal withdrawn from the circulation into a proper receptacle and maintained in a culture-oven at blood-heat, we will find that these bacteria multiply abundantly, and evidence of putrefactive decomposition will soon be perceived. But if we inject a like quantity of the culture-fluid, with its contained bacteria, into the circulation of a living animal, not only does no increase and no putrefactive change occur, but the bacteria introduced quickly disappear, and at the end of an hour or two the most careful microscopical examination will not reveal the presence of a single bacterium. This difference we ascribe to the vital properties of the fluid as contained in the vessels of a living animal, and it seems probable that the little masses of protoplasm known as white blood corpuscles are the essential histological elements of the blood, so far as any manifestation of vitality is concerned. *The writer has elsewhere* (1881) *suggested that the disappearance of the bacteria from the circulation, in the experiment referred to, may be effected by the white corpuscles*, which, it is well-known, pick up, after the manner of amœbæ, any particles, organic or inorganic, which come in their way. And it requires no great stretch of credulity to believe *that they may, like an amœba, digest and assimilate the protoplasm of the captured bacterium, thus putting an end to the possibility of its doing any harm.*"

"In the case of a pathogenic organism we may imagine that, when captured in this way, it may share a like fate if the captor is not paralyzed by some potent poison evolved by it, or overwhelmed by its superior vigor and rapid multiplication. In the latter event the active career of our conservative white corpuscle would be quickly terminated and its protoplasm would serve as food for the enemy. It is evident that in a contest of this kind the balance of power would depend upon circumstances relating to the *inherited* vital characteristics of the invading parasite and of the invaded leucocyte."

This explanation is now very commonly spoken of as the "Metchnikoff theory," although, as a matter of fact, it was clearly stated by the writer several years (1881) before Metchnikoff's first paper (1884) was published. Metchnikoff has, however, been the principal defender of this explanation of acquired immunity, and has advanced considerable experimental evidence in its favor. We cannot, at present, attempt to review the evidence for and against this theory, but may say, in brief, that in view of experimental evidence, shortly to be referred to, we are not prepared to accept it as a sufficient explanation of acquired immunity. We believe, however, that "phagycytosis" constitutes one of the

factors upon which immunity depends and plays an important part in enabling immune animals to resist invasion by pathogenic bacteria.

But recent researches indicate that the principal factor in the production of acquired immunity is the presence in the blood of the immune animal of some substance capable of neutralizing the toxic products of the particular pathogenic micro-organism, against which immunity exists. Or, in certain cases, in the germicidal action of some substance present in the blood and tissue juices of the immune animal.

These "defensive proteids" in the bodies of immune animals are called *alexines* by Buchner and *phylaxines* by Hankin.

In the nomenclature proposed by Hankin, a defensive proteid produced in the body of an animal which has an acquired immunity for a given infectious disease, and which acts by destroying the pathogenic bacteria to which the disease is due, is called a *mycophylaxin;* and a defensive proteid produced in the body of an animal which has an acquired immunity, which acts by neutralizing the toxic products of the pathogenic bacteria to which the disease is due, is called a *toxophylaxin.*

Our knowledge of these defensive proteids has been acquired during the past two or three years, and dates from the discovery by Nuttall (1888) that the recently drawn blood of certain animals possesses decided germicidal properties. Buchner has shown that this property belongs to the blood serum and not to its cellular elements. This germicidal power varies greatly for different species of bacteria, being more pronounced in the case of some pathogenic bacteria than for others, and absent in the case of some of the common saprophytes tested. The germicidal power of fresh blood serum is destroyed by a comparatively low temperature, and by keeping the serum for a considerable time, but it is not neutralized by freezing. Behring has shown that the blood of different animals varies considerably as to its germicidal power. Thus the blood of the rat and the frog is especially fatal to the anthrax bacillus, and the natural immunity of these animals against anthrax is probably explained by this fact. The substance to which this germicidal action is due appears to be destroyed in exercising its destructive action, for a given quantity of serum will only destroy a limited number of bacteria, and when these are present in excess they develop abundantly in the blood serum, which, in the absence of the defensive proteid, constitutes an excellent culture medium.

Hankin (1891) has isolated from the spleen and blood serum of rats a globulin, possessing germicidal properties, to which he ascribes the power of rats' blood to destroy anthrax bacilli. This globulin is insoluble in water or in alcohol and does not dialyze. In this connection we may state that other animal fluids have been shown to possess some germicidal power. This has been shown to be true of aqueous humor, of lymph from the dorsal lymph sac of the frog, of the fluid of ascities, and even of milk and of urine.

Reference has already been made to the experiments of Ogata and

Jashuara, which show that the anthrax bacillus becomes attenuated as to its pathogenic virulence when cultivated in the blood of an immune animal, such as the frog or the rat, and the similar results more recently obtained by Brieger, Kitasato, and Wassermann, in cultivating pathogenic bacteria in a thymus bouillon. Now this attenuation appears to be due to a destruction of the toxic products of the pathogenic bacteria by antitoxines present in the culture liquids. That such destruction may occur, in certain cases, at least, is proved by recent experiments made in Germany and Italy.

Behring and Kitasato, in their experiments upon tetanus and diphtheria, have shown that the blood of an immune animal, when added to a virulent culture of one or the other of these bacilli, neutralizes the pathogenic power of such cultures, as shown by inoculation into susceptible animals. And also that cultures from which the bacilli have been removed by filtration and which kill susceptible animals in very small amounts, have their toxic potency destroyed by adding to them the blood of an immune animal, which is thus directly proved to contain an antitoxine, which comparative experiments show not to be present in the blood of non-immune animals. In the experiments of Behring and Kitasato referred to, it was found that five cubic centimetres of serum from the blood of an immune rabbit mixed with one cubic centimetre of a virulent filtrate of the tetanus bacillus and allowed to stand for twenty-four hours completely neutralized its toxic power, as shown by inoculations in mice; 0.2 cubic centimetre of this mixture injected into a mouse was without effect, while 0.0001 cubic centimetre of the filtrate, without such admixture, was infallibly fatal to mice. The mice inoculated with this mixture remained immune for forty or fifty days, after which they gradually lost their immunity. The blood or serum from an immune rabbit, when preserved in a dark, cool place, retained its power of neutralizing the tetanus toxalbumin for about a week, after which time it gradually lost this power. Behring and Kitasato have also shown that the serum of a diphtheria-immune rabbit destroys the potent toxalbumin in diphtheria cultures. It does not, however, possess any germicidal power against the diphtheria bacillus.

The Italian investigators, Tizzoni and Cattani, have obtained similar results and have isolated from the blood of immune animals an albuminous substance, which they believe to be the tetanus antitoxine, and which has been successfully used in the treatment of a number of cases of tetanus in man.

G. and F. Klemperer have recently (1891) published an important memoir, in which they give an account of their researches, relating to the question of immunity, etc., in animals subject to the form of septicæmia produced by the micrococcus pneumoniæ crouposæ. They were able to produce immunity in susceptible animals by introducing into their bodies filtered cultures of this micrococcus, and proved by experiment that this immunity had a duration of at least six months. They arrive at the conclusion that the immunity induced by injecting filtered

cultures is not directly due to the toxic substances present in these cultures, but that they cause the production in the tissues of an antitoxine, which has the power of neutralizing their pathogenic action. The toxic substance present in cultures of the "diplococcus of pneumonia" they call *pneumotoxine*; the substance produced in the body of an artificially immune animal, by which this pneumotoxine is destroyed if subsequently introduced, they call *anti-pneumotoxine*.

In the experiments heretofore referred to, the destruction of the virulence of cultures by adding to them the blood of an immune animal has been shown to be due to the presence of an antitoxine. But we have also experimental evidence that immunity may depend upon the destruction of the pathogenic micro-organism in the blood of an immune animal. In guinea-pigs which have an acquired immunity against vibrio Metchnikovi the blood serum has been proved to possess decided germicidal power for this "vibro," while it multiplies readily in the blood serum of non-immune guinea-pigs (Behring and Nissen).

The writer has recently (May, 1892) obtained experimental evidence that the blood of vaccinated, and consequently immune, calves contains something which neutralizes the specific virulence of vaccine virus, both bovine and humanized. Four drops of blood serum from a calf, which had been vaccinated two weeks previously, mixed with one drop of liquid lymph recently collected in a capillary tube, after contact for one hour, was used to vaccinate a calf; the same animal was also vaccinated with lymph, preserved on three quills, which was mixed with four drops of serum from the immune calf and left for one hour. The result of these vaccinations was entirely negative, while vaccinations upon the same calf, made with virus from the same source, and mixed with the same amount of blood serum from a non-immune calf, gave a completely successful and typical result.

The importance of the experimental evidence above referred to, in explaining the phenomena of natural and acquired immunity, is apparent. The facts stated also suggest a rational explanation of recovery from an attack of an acute infectious disease. But the idea, that during such an attack an antidote to the disease poison is developed in the tissues, is yet so novel, and the experimental evidence in support of this view is of such recent date, that it would be premature to accept this explanation as applying to immunity in general. It seems difficult to believe that an individual who has passed through attacks of measles, mumps, whooping-cough, scarlet-fever, small-pox, etc., has in his blood or tissues a store of the antitoxine of each of these diseases, formed during the attack and retained during the remainder of his life, or continuously produced so long as the immunity lasts. Moreover, in those diseases to which the experimental evidence above recorded relates—diphtheria, tetanus, pneumonia—as they occur in man, no lasting immunity has been shown to result from a single attack, and in this regard they do not come into the same class with the eruptive fevers and other diseases, in which a single attack usually protects during the life-time of the individual.

Still, notwithstanding the considerable number of diseases in which we have as yet no experimental evidence as to the presence of a specific antitoxine in the blood and tissues of immune individuals, it must be admitted, that so far as the experimental evidence goes, it is in support of the view that acquired immunity depends chiefly upon the presence of defensive proteids in the bodies of immune animals. And, if this is true, the suggestion at once presents itself that we may be able to confer immunity upon susceptible individuals by introducing into their bodies the antitoxine of a specific disease obtained from the blood of other individuals who have an acquired immunity against this disease. That this is possible in the case of certain infectious diseases of the lower animals has already been proved, and the experimental evidence has been referred to.

Whether preventive medicine will be able to apply similar methods for the purpose of establishing immunity against the specific infectious diseases of man, can only be determined by carefully conducted experiments.

In the case of small-pox, the method of Jenner has been so satisfactory in its results, and is so simple in its application, that we would scarcely expect to substitute for it a method depending upon the direct introduction of an antitoxine, obtained, for example, from the blood of immune calves, even if experiment should show the possibility of establishing immunity in this way.

But in yellow-fever and scarlet-fever such a method might possibly be practicable and useful, if there were any way of obtaining an antitoxine from the blood of persons who have suffered an attack of the disease, in sufficient quantity to serve the purpose. Already experiments have been made in the therapeutic use of antitoxines in tetanus, and in pneumonia, with a very promising degree of success, and from our present point of view the practical application of the recent discoveries relating to defensive proteids seems to be in this direction rather than in prophylaxis.

In Pasteur's protective inoculations against hydrophobia, in persons bitten by rabid animals, it seems probable that an antitoxine is introduced with the emulsion of a spinal cord used in these inoculations, and that the protection afforded depends upon this fact. Or, possibly, upon the development of an antitoxine in the body of the inoculated individual, as a result of the introduction of a considerable quantity of a specific tox-albumin, produced by the hypothetical hydrophobia germ in the nervous tissues of the infected rabbit from which the spinal cord was taken.

Whatever may be the rational of the immunity resulting from such inoculations, the fact that they have a considerable prophylactic value appears to be well established.

This is shown by the following statistical tables:[2] one showing the results of inoculations made at the Pasteur Institute in Paris during five

[2] From the Annals of the Pasteur Institute, vol. v, pp. 345, 346.

years, 1886 to 1890; the other, a classified statement showing the results in a single year, 1890:

Year.	No. Treated.	Died.	Mortality.
1886	2,671	25	0.94
1887	1,770	13	0.73
1888	1,622	9	0.55
1889	1,830	6	0.33
1890	1,540	5	0.32
Total,	9,433	58	0.61

In the following table, *A* includes all persons treated who had been bitten by an animal proved to be rabid; *B*, persons bitten by animals examined by veterinary surgeons, and pronounced rabid; *C*, persons bitten by animals suspected of being rabid. The figures relate to the year 1890:

	No. Treated.	Died.	Mortality.
A	416	0	..
B	909	4	0.44
C	215	1	0.46

There has been much scepticism with reference to the value of Pasteur's hydrophobia inoculations, notwithstanding the favorable statistics published by the Pasteur Institute in Paris, and by similar institutions in other parts of the world. This has, however, to a considerable extent, given way before the experimental evidence. With reference to this we cannot do better than to quote from a recent report by Dujardin-Beaumetz. In this report the following statistical table is given, relating to the number of rabid animals as compared with the number of deaths from hydrophobia in the Department of the Seine, during a period of ten years, 1881 to 1891.

Year.	Cases of Hydrophobia in Man.	No. of Rabid Animals.
1881	21	615
1882	9	276
1883	4	182
1884	3	301
1885	22	518
1886	3	604
1887	9	644
1888	19	863
1889	6	367
1890	1	203
1891	4	400

In commenting upon these statistics, Dujardin-Beaumetz calls attention to the fact that the figures show three periods of ascension (1881, 1885, and 1888), in the number of rabid animals, attended with a corresponding

increase in the number of deaths from rabies in 1881 and 1885, but not in the years of 1886 and 1887, during which the relative number of deaths was considerably less. This is ascribed to the protective inoculations which were commenced in 1886.

If we compare the statistics for five years prior to 1886 (1881 to 1885 inclusive), with the five years following (1886 to 1890 inclusive), we find that during the first period there were 57 deaths from hydrophobia in the Department of the Seine and the number of rabid animals reported was 1,882, while during the second period the total number of deaths was 38 and the number of rabid animals was 2,681. That is, during the first period the ratio was one death to 33 rabid animals, and during the second, one death to 70 rabid animals.

According to Dujardin-Beaumetz, the total number of individuals living in the Department of the Seine treated at the Pasteur Institute from January 1, 1887, to December 31, 1891, was 1,224. Of these, 12 died, notwithstanding the treatment, giving a morality of 0.89 per cent.

During the same period, according to the above table, there were 39 deaths from hydrophobia among the residents of the Department of the Seine. We infer therefore that (39–12) 27 persons died during this period who had not submitted themselves to the Pasteur treatment. The mortality among those not treated, as compared with the number bitten, is stated to have been 15.9 per cent. in 1887 and 13.33 per cent. in 1888.

We have for some time had satisfactory experimental evidence that susceptible animals may be made immune against certain pathogenic bacteria by inoculating them, after the method of Pasteur, with "attenuated cultures." This has been shown by the savant named to be true of anthrax, of rouget, and of chicken cholera, and protective inoculations against these diseases have been practised to a considerable extent in France and in other European countries, in which these diseases prevail to such a degree as to call for such a measure of prophylaxis. But it is still a question, whether from a practical point of view this method is to be preferred to the isolation of infected animals and the destruction of the infectious material. Certainly the latter method would be preferable where but few cases of an infectious disease exist in a region where there are a large number of healthy animals to be protected from infection—in anthrax, for example. No one would think of immunizing all of the cattle in a state or a county because cases of anthrax had appeared on a particular farm.

In the interests of the individual farmer, it may be that protective inoculations practised among his herds which have been exposed to infection, would result in securing him against considerable losses. But such inoculations should not take the place of the isolation of animals already infected and the destruction of infectious material. If we had, for example, a satisfactory method of protecting horses against glanders by inoculations with an attenuated virus, no one would be inclined to advocate this mode of prophylaxis as a substitute for isolation and disinfection. But, on the other hand, in sections where anthrax causes annually a

heavy loss among the sheep and cattle, owing to the fact that the fields are already infected over extensive areas, as is the case in certain parts of Europe, the question of protective inoculations becomes an important one.

In the infectious diseases of man the same conditions would no doubt control our practice if we had a satisfactory method of protective inoculation for each of these diseases. In yellow-fever, for example, those would be inoculated who were compelled to expose themselves in an infected area; in scarlet-fever, those children who were shut up in the same house with a case of the disease, or who had in any way been exposed to infection.

In the case of Asiatic cholera, it may be questioned whether protective inoculations should be practised as a mode of prophylaxia, even if it were fully demonstrated that immunity of a certain duration could be effected in this way. Permanent immunity we could not expect to produce, inasmuch as one attack does not protect from future attacks, but that temporary immunity may be induced by inoculation with cultures of the cholera spirillum appears probable from Shakespeare's account of the results of Ferran's inoculations in Spain during the last outbreak of cholera in Southern Europe, and from more recent experiments upon lower animals, and also upon man by Haffkine and by Klemperer.

Brieger, Kitasato, and Wassermann have recently reported their success in conferring immunity upon guinea-pigs against the pathogenic action of the cholera spirillum. They found that attenuated cultures suitable for use as "vaccines" could be obtained by cultivating the spirillum in bouillon made from the thymus gland of the calf, by which means they have also obtained attenuated cultures of the bacillus of diphtheria, the bacillus of typhoid fever, the bacillus of tetanus, and the streptococcus of erysipelas. Guinea-pigs inoculated with a culture in thymus bouillon which had been subjected to a temperature of 65° for fifteen minutes, were found, after twenty-four hours, to be immune against virulent cultures in twice the amount which would otherwise have been fatal.

The virulence of cultures of the cholera spirillum is greatly modified by continuous cultivation in artificial media, and as shown by Haffkine, an attenuation of virulence may be quickly effected by cultivation in bouillon at a temperature of 39° C., with free access of oxygen. On the other hand, the virulence is greatly intensified by successive inoculations into the peritoneal cavity of guinea-pigs. Haffkine has shown that the attenuated cultures, when injected subcutaneously in man or in guinea-pigs, cause a local œdema and a slight febrile reaction, while the virulent cultures produce a more intense local reaction and may even give rise to necrosis of the tissues about the point of inoculation. But this severe reaction does not occur if an inoculation with the attenuated virus has been made some days previously. And animals which have been inoculated subcutaneously, first with an attenuated, and then with a virulent culture, do not subsequently succumb to intra-peritoneal injections of virulent cultures. Haffkine considers it probable that similar subcuta-

neous inoculations in man would give him a temporary immunity at least, and that they would be of prophylactic value during the presence of an epidemic. Ferran had previously demonstrated by his extended inoculations, that the introduction of the cholera spirillum into the subcutaneous connective tissue of man is a harmless procedure. This fact is verified by Haffkine's more recent experiments, which also show that a tolerance is thus established in man, as in the lower animals, against the local effects of subsequent inoculations with more virulent cultures.

Whether this method will be found to have any great practical value can only be determined by more extended experiments. But in view of the fact that other measures of prophylaxis, well known to sanitarians, are sufficient for the prevention of cholera epidemics, and that nurses and others who necessarily come in contact with cholera patients are not likely to contract the disease if they use proper precautions with reference to their food and drink, the disinfection of their hands, etc., we doubt whether protective inoculations will ever come into general use as a measure of prophylaxis against this disease. Certainly they cannot take the place of those sanitary measures which have been proved to be sufficient for the prevention of epidemics, namely, exclusion by a proper inspection service at ports of entry ("quarantine"), isolation of the sick, disinfection of excreta, general sanitary police of exposed towns and cities, boiling the water used for drinking purposes, etc. Still, under certain circumstances, protective inoculations may have considerable practicable importance, and the experiments now being made have evidently great scientific interest in connection with the question of acquired immunity. Klemperer, of Berlin, has recently reported very interesting results in this connection. By inoculating man with sterilized cultures of the cholera spirillum, he was able to establish a considerable degree of immunity, as shown by the fact that the blood of such individuals, when injected into guinea-pigs, protected them from the lethal effects of virulent cultures of the cholera spirillum. The cultures used in his experiments were sterilized by exposure for two hours to a temperature of 70° C., and eight successive subcutaneous injections were made. At the end of twelve days, the blood serum of an individual subjected to this treatment was found to protect guinea-pigs when injected into these animals in the amount of one quarter of a cubic centimetre. Klemperer has also ventured to inject non-sterilized cultures under the skin of man, and has obtained evidence that such inoculations give rise to immunity, as shown by the protective influence exercised by the blood serum of inoculated individuals when introduced into the bodies of guinea-pigs. These inoculations with non-sterilized virulent cultures (0.35 c. c.) gave rise to a severe local reaction and to some fever, but proved not to be dangerous.

In view of the experimental results above referred to, it has occurred to the writer that possibly the protective inoculations against yellow fever, practised some years since at Veracruz under the direction of Prof. Carmona y Valle, of the City of Mexico, may have had a rational basis not suspected at the time they were made.

Dr. Carmona gives the following account of his method of inoculation: "The method of performing the inoculation is very simple. In the first place, the urine of the sick is collected, taking care not to take that of patients suffering from any visceral affection, still less from gonorrhœa or syphilis. It is well to employ the urine secreted when the disease is well established, because it contains a greater quantity of zoöspores. This urine is placed in large shallow plates, and abandoned to spontaneous evaporation, having care that the evaporation is complete, and that no trace of humidity remains. If the layer of residue is very thick, it is well to spread it out so that it may be penetrated throughout by the oxygen of the air. By following this advice you will surely avoid the inoculation of the microbes of putrefaction. When the residue is well dried it may be used for the inoculation. I usually place one or two centigrammes of the dry residue in a gramme of distilled water. I triturate it in such a manner that the mixture is as perfect as possible, and charging a Pravaz syringe, I make a subcutaneous injection in the right arm. The results are various, but no serious accident has ever occurred.

"I was first inoculated September 29, 1881. I felt a lively pain at the moment of the injection and some minutes after, but it disappeared promptly, to give place to slight tumefaction, without redness of the skin, which interfered somewhat with the movement of the arm. The fourth day all had disappeared, and I really had no febrile movement, since the thermometer did not go more than a few tenths above 37°. The urine became scanty and took a slightly reddish color. The *malaise* was insignificant, and I continued my ordinary occupations.

"I count, to-day, nearly two hundred persons inoculated, and among them several experienced, some hours after the inoculation, a febrile movement, which sometimes caused the thermometer to mount to 38.5°. The duration of this febrile movement did not exceed twenty-four hours. The local accidents have been most varied. There was almost always tumefaction at the point of inoculation, but the extent and size of this tumefaction varied greatly. In many cases there was redness of the skin. These local phenomena lasted four or five days, but, in general, those inoculated continued about their ordinary affairs. Once only I have seen developed a phlegmon which terminated by suppuration."

Dr. Carmona says, in the above quoted account of his method, "It is well to employ the urine secreted when the disease is well established, because it contains a greater number of zoöspores." The writer has elsewhere given his reason for doubting whether Dr. Carmona's so-called "zoöspores" were, as for a time he supposed, the specific infectious agent in the disease under investigation. Without doubt a variety of micro-organisms would be present in urine which was permitted to evaporate spontaneously in a large shallow plate. But there is no satisfactory evidence that the urine of yellow-fever patients at the moment of its escape from the bladder contains any micro-organism other than those which are constantly found upon the surface of the mucous membrane at the meatus urinarius.

It is not improbable, however, that the highly albuminous urine of yellow-fever patients may contain specific toxic products which have escaped from the blood, and which in the body of the infected individual give rise to the morbid phenomena characterizing the disease. If so, Dr. Carmona's dessicated urine may have contained the specific toxalbumin (?) of yellow-fever in sufficient quantity to have produced a certain degree of immunity in the individuals inoculated by him. Certainly this is a possibility worthy of further consideration, and one that is not at all improbable in view of the facts heretofore mentioned, relating to acquired immunity in other infectious diseases as a result of inoculations with filtered cultures containing the toxic products of pathogenic bacteria.

In the absence of any precise knowledge of the specific infectious agent in yellow-fever, two possible methods of establishing immunity by protective inoculations present themselves. One, following the indication afforded by Professor Carmona's experiments, in which the object is to introduce a sufficient quantity of the specific yellow-fever toxalbumin, assuming that such a substance exists in the blood of yellow-fever patients during the progress of the disease. The other, to introduce into the circulation of susceptible individuals the yellow-fever antitoxine, which, reasoning from analogy, we suppose to be present in the blood of immune individuals.

In experiments to determine the possibility of establishing immunity by the first method, we would suggest that the urine had better be quickly evaporated *in vacuo*. Possibly, also, the toxic substance assumed to be present may be obtained in a more concentrated form, free from urinary salts and other impurities, by precipitation with alcohol, by dialysis, or by some other method known to physiological chemists. Again, it may be that the yellow-fever toxalbumin could be obtained by chemical methods from the blood of those recently dead. Evidently here is a broad field for experiment, but it is one in which special training will be required on the part of the investigator, and great conservatism in drawing conclusions as to results attained.

The second method suggested would be tested by injecting blood serum from an immune individual into the circulation (or subcutaneously?) of one susceptible to the disease, who must necessarily be exposed in an infected locality. Evidently numerous carefully conducted experiments would be required to establish the value of either of the methods suggested.

Another line of experiments which has suggested itself to the writer, would be to treat cases of the disease by the injection into a vein of blood serum from an immune individual. Possibly the, at present hypothetical, antitoxine might be present in such serum in sufficient amount to exercise a specific curative effect. This is one of the possibilities which can only be settled by the experimental method, but in the present state of science such experiments appear to the writer to be not only justifiable but extremely promising as to their results.

Yellow-fever is a disease in which a satisfactory method of establish-

ing immunity would be of great practical value, for susceptible individuals, and especially sailors and soldiers, are often necessarily sent to infected localities. The annual loss of life among those who venture to visit the endemic foci of the disease, for business or pleasure, is also very considerable. Moreover, this disease is one in which there is every reason to believe that an artificial immunity might be established if we could succeed in isolating and cultivating the specific infectious agent, for it is well established that an attack of the disease affords a very lasting immunity, which, however, is not absolute, against subsequent attacks.

The committee on "Protective Inoculations in Infectious Diseases" proposes to give, in subsequent reports, a detailed account of the results of protective inoculations, as practised in various infectious diseases of man and of the lower animals, and also to report, from time to time, such additions to our knowledge as have a bearing upon the explanation of acquired immunity, and upon methods of conferring such immunity without danger to the individual or to the public health.

APPENDIX.

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XLI.

YELLOW-FEVER IN VERACRUZ.

By Dr. NARCISO DEL RIO.

Veracruz, Mexico.

There is no doubt that the hygienic conditions of Veracruz have improved much within the last few years. The increase in population, which has caused a scattering of the residents, the introduction of water from Tamapa, and the removal of the walls, which has permitted an extension of the city and given it a better ventilation, are the most important factors which have contributed to this happy result. To these may be added the clearing of rubbish from the streets and gutters, and the partial drainage of the so called "Laguna de los Cocos," and of the general burying-ground, which, in the time of rain, had been completely flooded and converted into a great pond. Palustric-fever, yellow-fever, and a thousand other ailments had reigned continuously in the city, unfortunately giving it a sadly notorious reputation for unhealthfulness, which was justified at that time by known facts. The public health is much better now, and we may be certain that in "old" Veracruz only the recollection of its death-dealing atmosphere remains, and it has, to-day, one of the healthiest populations in the Republic.

Since yellow-fever has been one of those pests which have contributed to this very unfortunate reputation I propose to devote myself to-day to a discussion of this plague, basing my assertions on facts relative to the public hygiene of the city, which have come under my own observation.

The course which yellow-fever follows in Veracruz is somewhat peculiar. It does not make its appearance in the same intermittent way that is characteristic of this endemic in other localities, where it breaks out with intensity in the summer months, only to decrease and completely disappear during the following winter. In Veracruz there are some years when not even sporadic cases appear, others when much illness of a severe character is seen, others when the lighter forms of the disease predominate, and, finally, there are some years when it has made its appearance in the winter after a summer when not a single case has been observed.

Why it takes this course may be obscure enough; but it can be affirmed at the start that, in addition to the general conditions which are

admitted as necessary for the breaking out of the disease, there are in Veracruz certain local causes, which occasion its peculiar manifestation. I say "breaking out," and not "inception," because, in my judgment, the germ of the disease always exists in those localities where it is endemic, the co-operation of certain factors being necessary to make it break out. Among these admitted causes are the direction of the wind, excessive heat, the aggregation of unacclimated people, the digging up of the soil, etc. Out of all these I shall speak only of the removal of earth, because I believe that I can point out some coincidence between it and the appearance of the disease in its most severe forms.

Before I come to this I ought to emphasize the fact, that from time immemorial many authors have believed they could fix on yellow-fever a palustric etiology, and that even to-day, there are those who are of the same opinion; consequently I do not pretend to point out anything new—I only seek to state facts, without giving to them a greater importance than their intrinsic merits demand.

In Veracruz there had been three years for observing yellow-fever in its mildest forms, when, in 1881, it appeared in a most malignant type. In consequence of the tearing down of the walls, a hitherto unknown activity in building in the district called "extra-mural" ensued, owing to which the buildings were made of wood, and they had in their walls a menace of death during that epoch of revolutions, which happily is now passed. With the tearing down of the walls, and the removal of the soil, to make room for the foundations of new buildings (since most of the wooden houses were constructed on foundations of stone-work), came the yellow-fever in that severe form, so severe that it caused 723 deaths.

The following year there were no ravages, but when 1883 came we suffered a terrible epidemic, which is known among the people by the name of "de los Noruegos." This name was originated, because at that time there came to our port a number of ships of that country, bringing materials for the railroads then being extended, and among the sailors of these vessels there was a great loss of life, so great that one barque was unable to return home, because she had lost nearly all her crew by the epidemic. Now then, at that time the removal of the sand-bars which enclosed the city was progressing, and the ships were about to return in ballast made up of the sand taken from the bars. This visitation caused 747 deaths in the short time that it lasted.

During the three years following, the yellow-fever appeared each spring, but with medium intensity, causing an average of 220 deaths yearly, and it may be said that the removal of the sand in dredging the harbor and the moving of earth required by the erection of buildings, bore the same fruit as the levelling of streets in the extra-mural section and the cleansing of the "Laguna de los Cocos."

The four years which followed were a truce given by the disease, since during each year there were only from four to six deaths registered, and of these we may feel certain that nearly every one was from persons who came from Havana or Yucatan where the epidemic was then raging.

In the early part of the year 1891 some cases of vomit were observed—mild enough, however, since they occasioned a mortality of only 10 per cent. With the march of the Fourth battalion from this city to Papantla the disease was carried to the latter city, where it caused considerable havoc. On the battalion's return to Veracruz the fever fastened itself on the Second battalion, which had just come from the capital. Various excavations and embankments of considerable size were made about that time by the Interoceanic railway in order to complete its line to the population limit. This epidemic prevailed throughout the spring, and continued the following year, but with alternate periods of mildness and severity, having presented two special peculiarities worthy of mention. The first is, that the majority of cases appeared to be complicated with palustric fever, and the second, that while the condition of the city approached cleanliness, there were, nevertheless, carried forth daily from Ulúa six or eight victims, the disease being, as the term is, "localized" in that fortress. At that time the improving of the port had begun, and the wall which starts from Ulúa was to join with that which starts from the mainland. Large quantities of sand were carried thither daily for filling the dike, sand which was taken from the suburbs of the city and the lower portions of the fortress.

There are other facts which by deduction appear to confirm the large share which the digging up of earth has to do with the spread of yellow-fever. Sr. Dr. Molina has shown, by statistical data drawn from the observations of many years, that continuous elevated temperature, if it coincides with winds from the south, bids us, in Veracruz at least, to look for the appearance of the black-vomit. If we consider the topography of the city we see that southerly winds come from the land, and it is easy to believe that at each step the wind may seize on the germs scattered by the turning over of the soil, which, as is known, is frequent in our suburbs, on account of agricultural operations. This deduction is supported by the perfectly well known and easily proved fact, that each time the yellow-fever rages in Veracruz with any intensity and the winds blow from the north, the disease immediately breaks out in Córdoba, where it is always severe.

It is not my purpose to intimate that this would be the generating cause of disease, for it is known, and has been proved by others, that there are many factors necessary to give it birth, but, in truth, I seek to fix attention on the coincidences indicated, in order that competent persons may determine whether indeed there be in these facts an important factor of the breaking out of the disease, or whether they are coincidences merely without the relation of cause and effect. If they prove true in other places where unhappily the yellow-fever may be observed as an endemic, it would be to the advantage of the public health to prohibit the removal of sand-banks or earth, at least in the fierceness of the summer's heat, for powerful elevation of temperature at that season, and the consequent susceptibility which excessive heat has upon the individual economy, add to the danger.

I conclude by asserting, with all sincerity, that I make no claim of being particularly qualified to present these remarks to the consideration of this learned Association which honors us with its presence here; and that the truth of the facts stated, and my great desire for the remedying of a local evil which has wrought such great havoc among us, serve as my apology for the imperfect character of my work.

XLII.

THE RELATION OF RECENT BACTERIOLOGICAL STUDIES TO THE ETIOLOGY OF TYPHOID FEVER.

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The very large contribution made by typhoid fever to the death-rate in suburban and rural districts renders important the careful consideration of every new fact bearing upon the etiology of this grave infectious malady which may be presented as the result of authoritative investigation or research. The truth of this statement is emphasized by the fact that notwithstanding the discovery of a specific microbe by Eberth and the thorough establishment of the bacterial origin of this disease, there have still remained unexplained, many anomalous facts quite inconsistent with the theories respecting its etiology which the majority of sanitarians have felt themselves obliged, by the preponderance of evidence, to accept. For example, not infrequently epidemics have occurred under circumstances which have seemed to afford all but absolutely irrefutable evidence of the spontaneous origin of the disease.

Ripley studied typhoid fever in the Fiji Islands at its first known appearance, and was unable to discover any known source of infection. Maclean observed a similar epidemic on the island Ascension, and Metcalf relates a similar experience on the island of Norfolk. In each of these cases the disease was apparently spontaneous.

Numerous other cases, moreover, have afforded so much support to the fermentation theory that there has remained quite a respectable number of well qualified observers who hold to the views of Murchison, that the disease may originate *de novo* as the result of fermentation or other specific processes occurring in human excreta outside the body.

On the other hand, occasional cases, clearly demonstrating the contagious nature of the disease through personal contact of the well with the sick, have served to confirm the views of those who hold the theory of its specific character, as have also the results of inoculation experiments, apparently at least, in the hands of a few observers.

Another source of perplexity has been the fact that, notwithstanding the most exhaustive experimental researches conducted by numerous and most thoroughly competent observers, one very important evidence of the specific nature of the disease, or at least of the identity of Eberth's bacillus with the specific cause of this malady, has been lacking, namely,

the experimental production of a genuine case of typhoid fever. Inoculation experiments have produced death with some of the symptoms and lesions observed in typhoid fever, but it has been fairly objected to these observations that the lesions produced were not specific—that is, they were identical with the lesions produced by several forms of fatal infection induced in a similar manner.

This conflict of observations and theories has maintained an interest in the experimental investigation of the causes of this very infectious disorder, and with the development of the science of bacteriology and the attention of a large number of most experienced bacteriologists and most acute observers focussed upon the subject, it would be surprising indeed if new and important facts were not elucidated now and then.

The purpose of this paper is to present a sort of summary of work done by various workers in this field within the last three years, particularly respecting observations bearing upon the relation of the bacillus coli communis to the bacillus of Eberth.

The bacillus coli was first isolated by Escherich in 1885, being found in the stools of nursing infants. It was regarded by Escherich as a saprophyte. The peculiarities of this microbe especially noted by Escherich were its remarkable polymorphism and its close resemblance, when grown under certain conditions, to the bacillus of Eberth.

Hueppe, in 1887, called attention to the possible pathological importance of bacillus coli, having found the microbe in nearly pure culture in cases of cholerine, occasioned by drinking quantities of cold beer, and in cases of cholera nostras. His explanation of the relation of bacillus coli to these disorders was given in the theory that the microbe, while ordinarily innocuous, became malignantly virulent in consequence of biological changes resulting from growth in a favorable medium.

Rodet and Gabriel Roux began their studies of this bacillus in 1889, when in the study of an epidemic of typhoid fever they found it in almost pure cultures, although Eberth's bacillus could not be found. The bacillus coli was also found in the drinking water, in the use of which the epidemic originated. A fact which particularly attracted their attention was the discovery of Eberth's bacillus in the spleen of certain cases in which the stools presented nearly pure cultures of bacillus coli, while Eberth's bacillus was absent.

Subjecting the bacillus coli to the experiment of growth in various media, and under various temperatures, they observed that it assumed characters so nearly identical with those of Eberth's bacillus as to make the distinguishment of the two microbes a matter of no small difficulty. It was also observed that the typical forms of bacillus coli were more stable than Eberth's bacillus. Other observations led them to the conclusion that Eberth's bacillus is but a modified form of bacillus coli communis, its special characteristics being the result of the modifying influence of the conditions afforded by the human organism during the passage of the microbe through it.

Since these observations of Rodet and G. Roux, numerous other

bacteriologists have taken up the same line of investigation; among others, Vallet, of France, who has made a very exhaustive study of the whole question and presents a very convincing argument for the establishment of the identity of Eberth's bacillus and the bacillus coli communis. I shall attempt to briefly summarize the facts and observations which he deduced in support of his argument.

Comparing the two microbes, the bacillus of Eberth and the bacillus of Escherich, or coli communis, it is noticeable that both are pyogenic, purulent peritonitis and abscess having been produced by Roux, and various other observers, with pure cultures of the bacillus.

Chantemesse and Widal found Eberth's bacillus in an abscess fifteen months after an attack of typhoid fever, and G. Roux found the same bacillus in abscess of the kidneys and spleen after typhoid.

Bacillus coli has been observed in numerous pathological conditions, as abscesses, peritonitis, suppurative angio-cholitis, pleurisy, meningitis, and peritonitis resulting from perforation of the intestines. In several cases of hepatic abscess, bacillus coli has been found in pure culture.

Macé and Simonds found pure cultures of bacillus coli in the infectious diarrhoea of infants. Macé also found bacillus coli in the spleen in five cases of typhoid, and Wyss observed cases of fatal infection in the newborn which he attributed to bacillus coli.

A fact of interest which may be mentioned here is the observation several times repeated, in which the bacillus coli was present in water which had given rise to typhoid infection where Eberth's bacillus was not to be found. The frequent absence of Eberth's bacillus from water to which infection could fairly be attributed, has been a great perplexity to observers. M. Rodet recently reported the case of an epidemic of typhoid in which the bacillus coli was found in the drinking water in great quantities, although Eberth's bacillus could not be discovered.

Dr. V. C. Vaughan, of the University of Michigan, has found Eberth's bacillus absent in so many cases in which the water examined was clearly the origin of the disease, that he has been led to attribute specific characters to a number of distinct microbes, the characters of which he has carefully studied, not only bacteriologically but by means of inoculative experiments upon animals. The fact that it has not infrequently been possible to trace an outbreak of typhoid to a recent case, has led to the hypothesis that Eberth's bacillus may preserve its vitality for a long time, in some instances perhaps for a number of years, and under the most unfavorable conditions. This supposition has not, however, been supported by actual experiments. On the contrary, it has been clearly shown that the fluids of vaults are strongly toxic to Eberth's bacillus. It may be argued, and clearly with fairness, that the observations referred to respecting the relations of bacillus coli and typhoid fever are substantially identical with those which are relied upon to demonstrate the relation between Eberth's bacillus and this disease. It is found present in the disease, both in its primary and secondary lesions. The bacillus coli is found in waters which have given rise to epidemics of typhoid fever.

It is generally conceded that the typhoid bacillus undergoes a transformation in the body—probably in the intestines. This being the case, Eberth's bacillus ought to be found always present in the excreta of typhoid patients; but instead of this being the case, Gaffky, who made a more careful study of Eberth's bacillus than did Eberth himself, although subsequent to its discovery by Eberth, declared that he never found the bacillus in the excreta of typhoid patients.

Rodet and Roux found bacillus coli in the fæcal discharges of typhoid cases, but never observed Eberth's germ. A few observers, however, have reported finding Eberth's microbe in the discharges of typhoid patients between the 10th and 22d days, which it is easy to explain by the fact that it is during this period that the eschars from Peyer's patches are cast off. But as ulceration of Peyer's patches does not always occur, Eberth's bacilli are not always found in the excreta.

Charrin and Royer found the bacillus coli in the pleuritic fluid obtained from a case of hemorrhagic pleurisy occuring as a complication of typhoid, and on making a potato culture of the bacillus, observed that it presented characters nearly identical with those of Eberth's bacillus.

In another case Macé obtained bacillus coli from the spleen of a typhoid patient by puncture, while Eberth's bacillus was absent.

The biological characteristics of Eberth's bacillus and bacillus coli as noted by different observers are as follows:

Eberth's bacillus usually grows as an invisible film, but sometimes assumes a brown color similar to cultures of bacillus coli, as observed by Fraenkel and Simonds.

Bouchler produced luxuriant potato cultures of Eberth's bacillus of a brown color by rendering the medium alkaline with carbonate of soda. Malvos has also observed a brown colorization in cultures of Eberth's bacillus. The cultures of bacillus coli vary in color, from an almost colorless film to a thick brown coloration.

It is claimed by Chantimesse and Widal that Eberth's bacillus produces fermentation of milk sugar, while bacillus coli does not. This is not necessarily a distinctive characteristic, however, as it is well known that the yeasts may be deprived of their power of producing fermentation by growth under peculiar conditions.

It will thus be seen that there are no distinguishing features sufficiently characteristic to clearly separate the two microbes. The chief difference seems to be that the bacillus coli possesses greater vitality, is more vigorous in growth, and is more resistant. Eberth's bacillus appears to be an attenuated organism.

Inoculation experiments made by Vallet and Macé gave the same results for the bacillus coli as for the bacillus of Eberth.

Fraenkel produced ulceration of Peyer's patches in guinea pigs by inoculation with Eberth's bacillus in 1886.

Chantimesse and Widal obtained the same results in a rabbit in the following year.

The lesions obtained by inoculation with bacillus coli are thus stated by Macé in his treatise on biology:

> Les cultures inoculées aux lapins et aux cobayes par injections souscutanées ou intraveineuses, amènent la mort dans un laps de temps varient entre 1 à 3 jours. Les symptôms que suivent l'injection sont de fortes diarrhées et une sorte d'état comateux. A l'autopsie, on trouve l'intestin fortement hypérémié, presentant de nombreuses taches rouges, *les plaques de Peyer tuméfiées et souvent de l'épanchement dant le péritoine.* [The italics are ours.]

Vallet obtained identical results in two guinea pigs inoculated with the bacillus of Eberth and three animals of the same species inoculated with the bacillus coli. There was congestion of the spleen and tumefaction of Peyer's patches in both cases.

The virulence of bacillus coli was found to be very variable. As ordinarily found in the intestine, its virulence is comparatively slight, but it is modified by certain conditions which increase its virulence to an extraordinary degree.

In one case Vallet obtained Peyer's patches with a particularly virulent culture of bacillus coli. By passing a virulent culture through the guinea pig several times in succession, its virulence is modified, and these modified cultures resemble very closely attenuated cultures of Eberth's bacillus, becoming filamentous in form and very mobile. It is not claimed by any observer that a complete and absolute transformation of bacillus coli into the bacillus of Eberth, or the reverse, has actually been observed. It is only claimed that the effects produced by the two microbes are identical. That the bacillus coli should present itself in two conditions, one pathogenic and the other non-pathogenic, is certainly not novel to bacteriology. The same is true of the diphtheria bacillus and others.

The study of the bacillus coli, as found in vaults and cesspools, made by Vallet, presents some points of special interest. The paucity of our knowledge of the relation of the bacteria found in vaults to typhoid epidemics is due to the fact that most of the studies concerning vaults in relation to typhoid fever have been of a chemical nature, little attention having been given to the bacteriology of this subject.

Escherich, in the study of fresh fæcal matters, isolated the bacillus coli cummunis and bacillus lactis aerogenes. The principal previous studies of this subject were made by Uffelmann, who found that the bacillus of Eberth disappeared from a slightly acid mixture of fæces and urine at the end of a month, the cultures being kept at a temperature of 20°. In a tube exposed to ordinary temperatures, the bacilli disappeared at the end of three weeks. In a culture medium composed of rainwater, dry earth, and fæcal matter, there was a relative increase in the number of bacilli. No observation was made concerning the absolute number of bacilli at the beginning and end of the experiment.

In Vallet's experiments, Eberth's bacilli were added to liquid obtained from vaults, and carefully filtered through a Chamberlain filter. In this medium he found that the bacillus of Eberth invariably disappeared or

died within a few days, while the bacillus coli communis remained alive and multiplied rapidly.

Uffelmann showed that the bacillus of Eberth remained alive in water obtained from the wells of Rostock at atmospheric temperature only two weeks, while the bacillus of charbon survived over three months in the same water. It thus appears that Eberth's bacillus is the specific medium of infection in typhoid fever. Fæcal matters contained in the vaults or cesspools, constituting the sources of contamination of the drinking water in a given case, must be very frequently infected in order that they should preserve their virulence, since these microbes can survive under conditions afforded by a vault, only a week or two at the most.

The bacillus coli, on the other hand, not only thrives, but increases in virulence under the same circumstances.

The comparative inoculation experiments made by Vallet showed the bacillus coli of the vault to possess a virulence far exceeding either that of the bacillus coli obtained from the intestine or from fresh fæces, or the bacillus of Eberth, from which the conclusion is drawn that the growth of the bacillus coli, under the conditions afforded by the vault or cesspool, render it exceedingly virulent. In one case of inoculation with bacillus coli from a vault, the animal, a guinea pig, presented the most characteristic lesions which have been observed to follow inoculation with Eberth's bacillus, such as enlargement and congestion of the spleen, the liver, tumefaction and ulceration of Peyer's patches, etc.

The virulence of the bacillus coli was found to be increased during an attack of typhoid fever. This fact would seem to explain the contagion sometimes observed in severe cases.

Inoculation made with filtered liquid from vaults exerted a protective influence, which was also observed in the ingestion of water containing 30 to 40 c. c. per litre of liquid from a vault. Four rabbits, two of which were protected by filtered vault liquid, the others not, were inoculated with Eberth's bacillus. The protected rabbits, at the end of nearly two weeks, presented no material change. The rabbits which were unprotected, although not dead were greatly emaciated and suffered from severe diarrhœa. The protecting influence of the use of contaminated water, even against Eberth's bacillus, as shown by Vallet's experiments, explains the fact so often noted by sanitarians, that visitors to an infected locality are more likely to suffer from the disease than are residents.

I have recently made some experiments in the investigation of an outbreak of typhoid fever, which seemed to have an interesting bearing upon this question, six cases of typhoid fever having occurred within a short period in families using water from a single well. The attending physician was led to bring a specimen of the water to my laboratory for investigation. My assistant at once injected a large white rat with 5 c. c. of the water. The animal for several days appeared as well as usual, but then showed signs of illness, and died of infection at the end of 10 days. The post-mortem showed great enlargement of the spleen, and extensive

intestinal lesions; the whole of the small intestine was extremely friable, and its contents presented a yellowish color, which resembled very closely the appearance of potato cultures. The well of water which is believed to be the cause of the outbreak referred to, is surrounded with vaults and cesspools, four old deep vaults being located within a distance of thirty yards from the well. I am still pursuing the investigation of this water, which was first brought to my notice a few weeks ago, and I shall make, at a later date, a more complete report of the results obtained.

I desire especially to report the results of experiments for the purpose of determining the comparative toxicity of bouillon cultures of the bacilli of normal fæces, the bacilli of typhoid fæces, and Eberth's bacillus. A quantity of bouillon was prepared in the usual way,—300 c. c. of bouillon was inoculated with one c. c. of a saturated filtered solution of normal fæces. An equal quantity of the same preparation of bouillon was inoculated with one c. c. of a filtered solution of fæces obtained from a typhoid-fever patient in the latter part of the second week of the disease. A third portion of bouillon, of equal amount, was freely inoculated with a pure culture of Eberth's bacillus. The fourth portion of bouillon was preserved sterile. After growing the cultures for a few days at a temperature of 35° to 40°, the quantity was carefully filtered and neutralized, and their comparative toxicity determined by intra-venous injection of rabbits, with the following results:

Experiment 1. Material, sterile bouillon. A rabbit, weighing 2.320 kilos, received 427 c. c. by intra-venous injection before death occurred. The principal symptoms were frequent and copious diuresis, watery diarrhoea, slight clonic spasms, slow respiration, slight dilation of the pupils, corneal insensibility, and exophthalmus. The amount of urine required to kill, per kilogram, was 186.5 c. c. The temperature of the rabbit at the beginning the experiment was 39° C; at death, 36° 1 C, indicating a loss of 5.482 calories. The amount of heat communicated to the injected fluid was 7.728 calories, showing an actual gain of 2.246 in the number of calories produced, notwithstanding the great fall in temperature.

Experiment 2. Material used, bouillon culture of normal fæces. A rabbit, weighing 1.650 kilos, received by intra-venous injection 29 c. c. of the filtered culture, when death occurred. The symptoms were as follows: At the end of 30 seconds, pupils contracting; at one minute, pupils strongly contracted; at two minutes, clonic spasms, slow respiration, micturition; at two minutes and 30 seconds, continuous clonic spasms, cornea insensible; at the end of three minutes, pupils dilated, violent trembling, and death. The amount of fluid required to kill a kilogram of rabbit in this case was 17.57 c. c. The temperature of the rabbit at the beginning of the experiment was 39° C, at the end of the experiment, 39.4° C, a gain of .528 calories. The amount of heat communicated to the injected liquid in this case was .620 calories, making a total gain of 1.148 calories.

Experiment 3. Material, bouillon culture of typhoid fæces. A rabbit, weighing 1.540 kilos, received 20 c.c.of the filtered culture, when death occurred. The symptoms exhibited were, at the end of 30 seconds, slow respiration; at the end of one minute, contracted pupils; at two minutes, slight spasms; at three minutes, the contracted pupils very strong, clonic spasms, cornea insensible; at four minutes, death, pupils strongly contracted. Temperature, before injection, 38.6° C. Temperature at death, 39.1° C, showing a gain of .370 calories; injected fluid absorbed 0.422 calories, making a total gain of .792 calories.

Experiment 4. Material, bouillon of Eberth's bacillus. A rabbit, weighing 1.965 kilos, received 54 c. c. of the filtered culture, when death occurred, with the following symptoms: At the end of one minute the pupils were contracted to one half their usual size; at two minutes, pupils strongly contracted, slight exophthalmus, cornea sensibility diminished; at the end of three minutes, strong clonic spasms, and increased exophthalmus; death at the end of three minutes and 30 seconds. Temperature at the beginning, 39° C; temperature at death, 39.4° C, a gain of .628 calories, to which should be added 1.155 calories, the amount of heat absorbed by the injected liquid, making a total gain of 1.783 calories.

A most conspicuous fact in the results obtained in the above described experiments is the highly toxic character of all of the cultures, as compared with sterile bouillon, the coefficient of toxicity being 186.5 for sterile bouillon, 17.57 for the culture of normal fæces, 13 for the culture of typhoid fæces, and 27.5 for the culture of Eberth's bacillus. It will be noted, also, that but two thirds as much fluid of the culture of normal fæces was required to kill a kilogram of rabbit as with the culture of Eberth's bacillus, while the culture of typhoid fæces exhibited a toxicity more than double that of Eberth's bacillus. These facts appear to agree entirely with those obtained by Vallet with a different method of experimentation; namely, they appear to indicate that, when grown under identical conditions, the three bacilli—the bacillus coli of normal fæces, the bacillus of typhoid fæces, and Eberth's bacillus—exhibit different degrees of activity, either as regards their rate of growth, or as regards the character of the toxic agents which they produce, the bacillus coli of typhoid fæces exhibiting a distinctly higher degree of virulence or activity than the bacillus coli communis, and both exhibiting a much higher degree of activity or virulence than does Eberth's bacillus, another confirmation of the suggestion that Eberth's bacillus is really an attenuated form of the bacillus coli. Whatever results may have been noted by other observers, with this method of investigation, I do not know, as I have never seen any reported, and I am yet unable to make any statement respecting the comparative toxicity of the cultures of microbes of different species; but this method of investigation, introduced by Bouchard as a means of studying the toxicity of the urine, appears to me to present a very important and interesting field of investigation. It is interesting to note that the physiological effects produced in the above

experiments by the different cultures employed were very similar in character.

The wide dispersion of the bacillus coli, its virulence after a sojourn in vaults and cesspools, and its wide dispersion through the discharge of cesspools and sewers into lakes and rivers, gives great importance to this subject, even if it be considered not proved that the bacillus coli is capable of producing typhoid fever, since its significance as regards cholera nostras and cholerine has been clearly indicated by Hueppe. The use of water contaminated by human excreta, and hence containing bacillus coli, for drinking purposes, is certainly not the only means through which human beings are exposed to infection from this source.

The dry-earth closet does not destroy the fæcal matter which it receives, but preserves it in a form easily convertible into fine dust, which offers itself to every passing breeze for distribution and conveyance to various articles of food and drink, which may afterwards be ingested by human beings.

The so called dry-closet system, which has recently been introduced into some of the larger cities of the United States and Canada, offers peculiarly excellent facilities for the distribution of this dangerous microbe. The readiness with which it grows in such media as milk, renders the infection of dairy utensils by washing with contaminated water an efficient means of inoculation. This may be one of the most common sources of diarrhœa and other disorders of the alimentary canal, so common in children fed upon cows' milk.

Another possible source of infection, to which the writer first called attention several years ago, when engaged in the study of this question as a member of the state board of health of Michigan, is inoculation of the milk during the process of milking by dust and particles of excreta falling into the milk receptacles, from the body of the cow and other sources. That such contamination of milk does occur, is evidenced by the gleanings of the milk strainer, which in some form is in universal use for the purpose of removing the masses of impurity of the sort mentioned.

That these particles of bovine excreta may often contain the microbic elements of typhoid infection is a belief which the writer has long entertained, and published several years ago. Whether or not the bacillus of Eberth or bacillus coli can survive passage through the alimentary canal of the cow is a question which has not yet been settled by experimental evidence. A year or two ago I undertook some experiments for the purpose of settling this question. A calf was fed for a number of days upon milk which had previously been sterilized, then inoculated with Eberth's bacillus and other bacilli, which had been separated from water which had given rise to typhoid fever, and the toxic nature of which had been demonstrated experimentally by inoculation. The excreta of the calf were carefully collected, and were subjected to a critical pathological study by Prof. F. G. Novy, M. D., of the laboratory of hygiene of the University of Michigan. Eberth's bacilli were not identified, but bacilli

so closely resembling those with which the milk had been inoculated as to warrant the supposition that they were merely modifications of the same, due to the influence of the medium of growth presented within the intestines of the animal, were discovered in considerable numbers. One of these, which closely resembled the bacillus coli in its mode of growth and general characteristics, was found in the discharges of the calf after taking the inoculated milk, but not in the excreta obtained before the beginning of the experiment.

I am, at the present time, conducting experiments in the laboratory of hygiene connected with the medical institution of which I have charge, and hope to be able to present more positive and satisfactory results upon this point in the near future. If the bacillus coli can survive transit through the alimentary canal of the cow, it is evident that safety for human beings can only be secured by providing for cows, at least when kept for milking, a water supply as free from contamination with excreta as that provided for human consumption. Recent experimental evidence upon this question certainly gives considerable support to this theory.

In a recent number of the *Duet. Med. Woch.*, Professor Gaffky mentions three cases of infectious enteritis which were traced to the use of milk contaminated by the dejections of a cow suffering from hemorrhagic enteritis. The patients were the employés of the Institute of Hygiene of Giessen. All three were infected by the disease at the same time, after partaking of milk which had been brought to the laboratory in a closed bottle the day before. The symptoms, though varying in intensity, were essentially the same in character in all three of the cases, consisting, at the beginning of the disease, of headache, repeated chills, and malaise. In one of the cases, more severe than the others, there appeared later a high fever, accompanied by stupor, coated tongue, abdominal tympanitis, with tenderness to pressure, frequent scanty stools of a dark brown color, and, on the 11th day, an intestinal hemorrhage. The urine was albuminous and contained granulous cylinders and leucocytes, but no red blood-corpuscles. Albumen was found in the urine until convalescence was established. The fever continued until the nineteenth day.

Careful bacteriological examination of the dejections of the three patients and the sick cow enabled the observers to discover a small and very mobile bacillus, the cultures of which were found to be extremely virulent, producing, by inoculation, fatal results in mice and guinea pigs.

The same bacilli were also found in the mucous membrane of the intestines of the cow. Neither the blood nor the milk of the cow, when withdrawn with antiseptic precautions, contained the microbe, showing that it must have found its way into the milk during the process of milking, through the media of several particles of excreta falling into the vessel used to receive the milk.

CONCLUSIONS.

The facts and arguments presented seem to justify the following conclusions:

1. The bacillus coli and the bacillus of Eberth are so nearly identical in their biological characters that none of the numerous methods proposed for distinguishing them can be relied upon as giving constant results.

2. The bacillus coli gives, in inoculation experiments, identical pathological effects with those produced by the bacillus of Eberth.

3. The bacillus coli acquires, by passing through the body of an animal, biological characters closely resembling those of Eberth's bacillus. The bacillus coli found in vaults is much more virulent than the bacillus coli of the intestines or Eberth's bacillus.

4. The bacillus coli is much more resistant than the bacillus of Eberth, and prospers in vaults, while the bacillus of Eberth quickly dies under the same conditions.

5. The study of epidemics and the bacteriological study of waters which have given rise to typhoid fever, lead to the conclusion that the bacillus coli at least shares with the bacillus of Eberth the property of producing typhoid fever under certain circumstances, and that the bacillus of Eberth is a variety or modified form of bacillus coli.

6. The contamination of milk with the excreta of cows is a possible source of infection with the bacillus coli and with typhoid fever.

7. The same care ought to be preserved in the protection of water used by cows kept for milking purposes from contamination with excreta as for that used by human beings for drinking purposes.

8. Since vaults and cesspools constitute depots, in which the comparatively innocuous bacillus coli acquires malignancy and virulence, rendering it highly destructive to human life, these convenient nuisances should be prohibited by law, and the destruction or disinfection by proper agents, or conveyance to a safe distance from human habitation, of all alvine discharges, should be compulsory as one of the most important means of conserving the public health.

XLIII.

MALARIOUS LOCALITIES—HOW THEY MAY BE RENDERED SALUBRIOUS.

By CHARLES SMART, M. D.,
Major and Surgeon, U. S. A.

I desire to bring to your notice an interesting point in the recent medical history of one of our military posts. Before doing so, however, it may be well to recall the precise state of the sanitary question which seems to be definitely settled by the medical record of this post.

Nearly twenty years ago, while investigating the seasonal differences in the water supply of Fort Bridger, Wyoming, I found that its impurity always coincided with the period of prevalence of remittent fevers. This, alone, would have proved nothing as to any causative relationship; but certain other considerations tended strongly in this direction. The post was situated at an altitude of 7,000 feet. The maximum temperature of its hottest months was 87° F.; the mean, 65°. No marshes were to be found in its neighborhood, and the streams which ran through it had a good fall, rapid current, and high banks. Troops from Florida, imbued with ague, speedily recovered their health and spirits in its invigorating mountain climate. It certainly was a non-malarious station, and yet whenever the organic constituents of the stream, which supplied the drinking water, were such as to yield high rates of albuminoid ammonia, remittent fevers became prevalent. Many other facts and experiences entered into the argument to prove the causation of these fevers by the water supply, but it is needless to recapitulate them here, as they are given in full in a paper on "Mountain Fever and Malarious Waters," published in the *Medical Journal of the Medical Sciences*, January, 1878. This paper met with favorable comment at the hands of Prof. DeChaumont, who made an abstract of it for the British Army Medical Report, and instanced some investigations in the high lands of India that seemed to sustain the theory of malarious waters.

Nevertheless, in this country the paper made few converts. Our medical men, particularly in the South, where remittents are endemic, were pervaded with the idea of an aërial poison generated in the soil by the combined influence of heat and moisture on its organic matter, and exhaled therefrom during the hours of darkness, low-lying, creeping over the surface, wafted by the winds, but readily dissipated by the warm rays of the sun. Exposure to malaria accounted for all the cases;

and if, in some instance, the source of the malarial emanation was not discovered, the failure was attributed to a want of thoroughness in the investigation. Similar views prevailed in Europe, where, in the search for the exhaling surface in obscure cases, even the garden mould in flower-pots on the bedroom window sill was convicted of guilt by so great an authority as Tommasi-Crudeli.

Malarious waters usually exist in malarious districts, where all classes of malarial disease may be readily attributed to the aërial miasma. It is, therefore, difficult to prove the relationship of cause and effect between the impure water and the disease following its use. During my service with the National Board of Health I had a number of experiences which strengthened my belief in the theory of water causation. For instance, when examining the cisterns of New Orleans, La., a former president of this association, Dr. C. B. White, brought me a water sample suspected to contain lead. I reported it to be a cistern water free from lead, but so charged with organic matter as to be equivalent to swamp water, and hence dangerous in view of remittent fever. Having given this opinion, I was informed that the cistern was situated in the well paved and non-malarious part of the city, and that the owner of the premises, a woman who used no other water and who had not been away from the vicinity of her home for many months, was then dangerously sick with remittent fever. The suggestion of lead in the water was made merely to keep the analyst ignorant of the real object of the inquiry, which was whether the character of the water would account for the otherwise unaccountable presence of the fever.

The repetition of such experiences led me to regard the occurrence of remittent fevers in cities supplied with surface water as due to malaria in the water, just as those of Fort Bridger were due to the organic impurity of the stream which was its source of supply; and at the meeting of this Association in Detroit, Mich., in 1883, I had the honor to invite attention to the subject in a paper entitled "The Prevention of Malarial Disease," showing the probability of the existence of the malarial cause in such waters and the possibility of removing it by filtration. The paper ended with the following sentence: "These views are submitted to the Association not as sustained by the testimony brought forward, but as having so much support from observed facts as to merit consideration and to call for a close and continued study of the modes of entry of malaria into the system, to the end that, if sustained, the remedy, which involves only an outlay of money, may be applied."

Since then, and without the publication of much new or striking evidence, the theory of the ingestion of malaria in the drinking water has been extensively accepted. Valuable testimony was reported from India in 1884. Large districts at the base of the Himalayas, which were regarded as uninhabitable on account of the deadly fevers that prevailed in them, were successfully settled by constructing masonry wells forty feet deep. The change from insalubrity to health was sharply marked and coincident with the abandonment of the use of surface waters.

These reports were but slightly noticed in the English medical journals, as the British practitioner at home has little interest in remittent fevers; and our own journals also failed to bring them into prominence.

Our army medical officers, for some years back, have been urging earnestly the supply of our military posts with water free from possibilities of typhoid fever. The success of their efforts in this direction has been marked by a gradual lessening of the malarial rate of sickness in the army as a whole. Much of the reduction must be attributed to improvement in drainage, in the construction of barracks, and the abandonment of insalubrious posts. Some medical officers, however, discovered a marked diminution of their local malarial rate subsequent to the introduction of the new and purer water supply. Dr. M. K. Taylor, for instance, reported this from Fort Sill, Okla. "It is difficult, however, to determine from the sick rates of a post what is its actual malarial rate, for the troops are frequently out on field service, where they meet with exposures that place many of them on sick report on their return, and their malarial diseases are credited to the post, although it may be situated in a dry and perfectly healthful location. Statistics vitiated in this way have thrown a veil of doubt on the results that have been claimed, because the claim necessarily rests on the statement of the medical officer that few or none of the malarial cases originated at his post."

However, the post surgeon at Fort Brown, Texas, presented during the past year a report that is free from ambiguity. This post, opposite Matamoros, on the Rio Grande, has heretofore been regarded as a notoriously unhealthy station, owing to the prevalence of malarial fevers. In his annual report for the fiscal year 1889 the surgeon-general of the army says [page 27],—

"At Fort Brown, which must be set down as the most unhealthy post in the country, 286 cases of malarial disease, or nearly two attacks yearly to each man of the 144 constituting the garrison, added 1,986.11 to the admission rate per thousand of strength and 26.72 to the non-effective rate. These fevers alone gave this post a much higher rate of admission than was given to the army by all diseases and injuries. Thirty-two venereal cases also figured largely in increasing the rates, particularly that of non-effectiveness, to which thdy added 20.61. The sanitary site of this post, its rotten and worthless buildings, and the proximity of the towns of Brownsville and Matamoros, sufficiently account for the sick record which it presents."

On page 32 of the same report the medical director explains what he considers to be the cause of the sickness:

"During the month of November, 1888, 58 per cent. of the command at Fort Brown was taken on sick report for intermittent fever alone. This does not fully represent the ill health of the command. On an inspection of the post, February 24, 1889, when the number of admissions had fallen much below that of November, I found members of nearly all the officers' families suffering with some form of malarial troubles. I

was informed that many of the men, when suffering from chills, preferred continuing on duty to reporting sick. The washed-out appearance of nearly every soldier in the command plainly showed the unhealthy surroundings. This post is closely hemmed in on the north by a large town (5,000 or 6,000) which is practically undrained and filthy beyond description, on the east by a marsh, and south by a lagoon, which for eight months of the year is cut off from the river. Into this marsh and lagoon all the sewage of the post drains. The lagoon is within thirty feet of the officers' quarters, and the marsh crowds up on occupied buildings on the other side. There must be taken into account the probability of the command being hemmed in by a yellow-fever quarantine. It will be a mild epidemic that does not decimate it in its present condition. If this unwholesome spot must be occupied I can only recommend that the garrison be reduced to the minimum and entirely changed every year."

In the report for the year 1890, Fort Brown is again shown to have the worst record of any post in the army, and on page 37 it is stated that,—

"If Fort Brown, Texas, were expunged from the list of military stations, the prevalence of malarial disease in our army would be greatly reduced. That post had an admission rate of 1,876 per thousand of strength and 38.58 of non-effectiveness."

This is certainly enough to define the reputation of this most undesirable station.

However, in the report for the following year, 1891, a change is observed to have occurred, but no explanation is given. Speaking of malarial fevers, page 30, it is said that,—

"The record of Fort Brown, Texas, was much improved during the year. Instead of 1,876 admissions per thousand of strength it had only 325.91, and instead of 38.58 of non-effectiveness it had only 8.32. This alone does much to account for the lowering of the malarial rate of the army. Seven posts had relatively more admissions and non-effectives than Fort Brown."

During the past year a rapid improvement in the health of the post was observed. The admission rate for malarial disease was only 16.13 per thousand of strength, and its non-effective rate 0.35, the average malarial admission rate of the army having been 62.23, so that this post, which had for so long the unenviable repute of being the most unhealthy of the army, has changed position on the list, and this notwithstanding the continuance of all its unsanitary surroundings, the undrained and filthy town on the north, the marsh crowding up on the east, and the lagoon cut off from the river for eight months of the year almost at the doors of the officers' quarters on the south.

In view, however, of the knowledge already gathered concerning malarious waters, we have not to seek long for the cause of the change at Fort Brown. During the years of insalubrity the garrison drank the muddy and impure water of the Rio Grande, and during the past, and part of the previous, year they drank a non-malarious water. In 1890

an ice machine was sent to the post to supply the fevered sick in the hospital with ice for cooling draughts. It answered its intended purpose efficiently, but incidentally it did much more. It prevented the very fevers which it had been sent merely to alleviate. A condensing coil was attached to the machine, which was thus enabled to supply the garrison with cool, distilled water, and as this was so much superior to the former supply it was immediately used by all for drinking and cooking.

This appears to me to establish the doctrine of malarious waters by testimony not drawn from meagre reports in general terms of what has been effected by the use of deep well water in far away India, but by the full and accurate records of the medical department of a military post, which is even nearer to this city of Mexico than to the city of Washington, to which its reports are rendered.

Commenting on the lessened malarial rates of Fort Brown and other Texas posts that are supplied with ice machines, Surgeon-General Sutherland has recommended their issue to other posts that have a water supply of doubtful quality.

Distilled water for potable or culinary use is free from all danger in times of epidemic, whether of typhoid, cholera, or yellow-fever. Every circular issued recently by boards of health, national, state, or local, in anticipation of cholera, has referred to the danger in the water supply, and has directed the boiling of water to eliminate that danger. Water from a condensing coil is just such water as has been so generally recommended. It is free, also, from the danger of propagating the malarial fevers that are endemic in so many parts of the American continent.

In ordinary times the boiling or distillation of water is too costly for the general supply of large communities. Typhoid and malarial fevers are those which should be excluded. Every water that is tainted with sewage has typhoid possibilities, and, as has been shown by the Standing Committee of this Association on Pollution of Water Supplies, the only method of avoiding these possibilities is to obtain a water free from sewage contamination, and to preserve it in that condition. Surface waters that from the character of their water-shed are free from danger of typhoid, may nevertheless be credited with malarial possibilities; and if the albuminoid ammonia distilled from them in laboratory experiments be large the possibility becomes a probability. Fort Brown was accounted a most insalubrious station, owing to the malarious exhalations from its marshes and lagoons, yet it seems that so far as regards sickness from such exhalation it was no more insalubrious than any of our sea-coast health resorts. The so called endemic fevers of this great continent are the same fevers that until now have been called endemic at Fort Brown. Intermittents in the spring and the remittents in the autumn undermine the health and destroy the energies of numberless communities, and their sites have been and are regarded as insalubrious, without remedy until several generations of sufferers shall have reclaimed the marshes and overflowed lands. This may be the case in many instances, yet the question arises, How many others are insalubrious only

as Fort Brown was insalubrious? How many of our people might have been saved, like the garrison of that post, from the ravages of severe autumnal epidemics by ceasing to take into their systems the prime cause of the disease in every glass of water which they drink!

During the prevalence of these fevers in scattered settlements depending on cistern water, the plan of boiling the water before use is judicious, particularly when, as is usually the case at such times, the water is low and the sediment thick and foul. For larger communities dependent on a general supply from surface collections, ponds, lakes, dams, or flowing streams, some other means of public protection must be adopted. If the water is obtained from a large and generally turbid steam, every effort should be made to provide a purer supply, because typhoid as well as malarial fevers may be propagated. If the water is derived from sources that are free from sewage, the elimination of the malarial poison only has to be considered.

The methods in use of purifying surface water are sedimentation and filtration. Sedimenting basins are in general use in the United States, but we have no information concerning the influence of this process on malaria in water. Perhaps, were the sedimentation prolonged sufficiently, the impurity, including the malarial cause, might be precipitated; but we do not know this. We do not know, however, that sedimentation as generally effected is not sufficient to render a malarious water harmless. The water of the Rio Grande was pumped into sedimenting tanks for the supply of Fort Brown during the whole period covered by its record of insalubrity.

On the other hand, we are fully aware that the changes which take place in a water during its filtration by natural means are all sufficient to deprive it of a malarial taint. No malarial disease has ever been attributed to deep well-water; and the substitution of such a water for surface supplies has always lessened the malarial rates of the people thus supplied. Whether filtration as artificially effected, either by filter beds in connection with sedimenting basins as used in England, or by the filtering plants that have been established by many in the United States, be effectual in removing malaria, remains to be ascertained by a study of the health records of these towns before and after the use of the filtered water.

At all events, artificial filtration offers the best known means, outside of distillation, for rendering a surface water non-malarious, and of relieving localities hitherto regarded as insalubrious from their evil repute in this respect.

XLIV.

THE QUARANTINE OF THE FUTURE.

By W. C. VAN BIBBER, M. D.,

Baltimore, Md.

What kind of a quarantine shall governments offer to the commerce of the world?

The answer is a plain one; it must be a *pleasant* quarantine. Nor is this plain answer as new and original as it is generally supposed. As far back as the time of Erasmus, it is said in one of his letters, "I have read how a city was once delivered from a plague by a change in the houses, made at the suggestion of a philosopher."

In More's "Utopia" this passage occurs:

> In the circuit of the city, a little without the walls, they have four hospitals, so big, so wide, so ample, and so large, that they may seem four little towns. . . . . These hospitals seem so well appointed, and with all things necessary to health so furnished, and, moreover, so diligent attendance through the continual presence of cunning physicians is given, that, though no man be sent thither against his will, yet, notwithstanding, there is no sick person in all the city that had not rather be there than at home in his own house.

Coming down to more recent times, I quote from an editorial in the Baltimore *Sun* of September 16, 1892, in which it is urged that,—

> A quarantine against the introduction of any plague from a foreign country must be enforced on the frontier. On the sea-board it must be enforced at the seaports where persons and goods from abroad find entrance and admission into the country. In the course of an admirable article in favor of national control of all the quarantine regulations in the *Medical News* of September 10, Dr. E. O. Shakespeare, the well known cholera expert and newly appointed health officer of Philadelphia, puts this pertinent and unanswerable question:
>
> "Why should the direction, expense, and responsibility of a system of common defence against the inroads of foreign diseases any more than against invasions of foreign foes be assumed and borne by those municipalities and states that happen to have a maritime location? Why should the vast majority, located inland, be allowed to shift their responsibilities and obligations, or be denied a voice in the direction of affairs which so closely concern them? The protection of the public health by maritime quarantine is a matter that interests not merely a narrow belt of seacoast; it seriously concerns the whole of the vast territory between our shores.
>
> "The last terrible yellow-fever invasion, which threatened to extend far up the valleys of the Mississippi and Ohio rivers, attracted the attention of congress, and led to the enactment of a law in 1890 investing the president with large powers in regard to a quarantine between the states. Those powers should now be extended and defined so as to embrace every case of possible infection coming from abroad. And out of the national treasury, not at the expense of particular states or cities, still less out of the pockets of

patriotic and philanthropic citizens should come the means for the establishment and maintenance at every exposed point, especially at all the large seaports, of adequate quarantine establishments, prepared and equipped beforehand to meet all probable emergencies in a manner conformable to the civilization of the age and the dignity and greatness of this country."

A pleasant quarantine can be made, one which with the combination of arts and sciences now at command shall inspire general confidence.

Again, at the quarantine conference held in Montgomery, Ala., in March, 1889, the idea of a pleasant quarantine was outlined and detailed. A pen and ink sketch was given of the principle, as well as an illustration to show its practical working.

In speaking of the quarantine of the future, it was said,—

I desire to enlist your interest in the design of an establishment for the promotion of health and the suppresion of disease, and particularly for the prevention of cholera, etc., in the United States.

I will call my design, for the present, a system of quarantine, as its first object is to prevent the introduction and spread of communicable diseases. But I energetically protest against my views suffering prejudice by reason of the repellant associations which are too often—and often too justly—connected with that name. As the hospital of to-day is something very different from the "lazaretto" or lepers' house of the Middle Ages, so the quarantine of the future must be something different from the inefficient, and, at best, unattractive quarantine of to-day. I will therefore call it "The Government Bureau of Health and Quarantine." And I look forward also to a system which will be not only scientific and effectual, but attractive; so that those for whom it is provided, whether for personal treatment or public safety, will rather be lured to it than repelled, and the sick gladly avail themselves of its beneficent arrangements. I look forward to an establishment worthy of any government which may found it, and a pride to her citizens.

If such a result be desirable, and if the design which I shall broach promises to realize such a result, then it remains to explain to the public what a well-equipped and scientific system ought to be and may be; and how thoroughly, if supported by wise laws and seconded by public opinion, it can now cope with those communicable diseases which have been often causes of wide-spread suffering, and of the wildest terror.

There is an old saying that "Afflictions are often blessings in disguise." Though in no case, perhaps, is the disguise thicker and harder to penetrate than in that of a great epidemic, yet even here it lies with us to make the proverb good, if the afflictive experience leads us to devise improved modes of building, and other measures for continued cleanliness intended to prevent the recurrence of cholera.

Recent advances which have been made in the study of the quarantined diseases will permit some things to be done now with safety which were not formerly allowed. For example, *formerly*, if a community proposed to place a quarantine establishment in an accessible, convenient, and desirable situation, such opposition would be made, and such influences brought to bear, that the eligible site would have to be abandoned, and the buildings necessarily located in some unattractive, inconvenient, and perhaps unhealthy, place,—turned out into the wilderness like the scape-goat and pursued even there by the fears and aversion of the whole community. All this is, or should be, a by-gone state of things. In Baltimore, when, more than sixteen years ago, the late Johns Hopkins bought thirteen acres of land within the city, and proposed to build thereon a public hospital, there arose strong opposition on the ground of prejudice and the dread of spreading disease; but now that the noble foundation which bears his name is erected, none of this feeling exists. Our people are logical, and it did not take long for the objectors to see that the function of a hospital is to extinguish disease, not to spread it; and that communicable diseases are far less dangerous to the community when confined under the immediate control and supervision of a corps of physicians and nurses, who may be able

to sterilize the germs emanating from infected patients, than if these latter were allowed to scatter themselves throughout the community and become foci of infection at many points.

The fact is, that it is only necessary for the people to understand how different the well appointed scientific quarantine of the present day ought to be from the traditional quarantine of the past, for their views and prejudices to undergo a radical change.

A properly built and appointed quarantine may be an embellishment to any city. Its buildings should be imposing, its grounds spacious, ornamental, and well kept, and have the beauty and the advantages of a public park. The establishment becomes one of the attractions of the city, and neighboring property is enhanced in value. Those who have seen the Johns Hopkins hospital (to which Baltimoreans always take guests from abroad, as one of the chief attractions of the city) can bear out what I say.

If proper ideas can be disseminated on this matter; if the people can be convinced that a quarantine can be made safe, efficacious, and at the same time attractive, that it will effectually prevent not only the spreading of disease, but the spreading of panic, such a quarantine will certainly enlist in its favor the whole body of public sentiment. But, to attain this desirable end, the community must be enlightened as to the results which have followed the study of quarantined diseases and the use of sterilizing agents in combatting them.

The diseases now quarantined in this country (the United States) are four : Cholera Asiatica, yellow-fever, small-pox, and typhus fever. It is the clear and urgent duty of all people to prevent the introduction of these diseases into any country if they can. That it can be done, if the proper means are taken, is universally believed.

How shall we, as a convention, recommend making the attempt ? It is not without preparation that I offer a plan.

It consists of large and spacious buildings as a quarantine, situated on the most commanding and attractive location; and these buildings should be connected with the city where located by means of railroads, telegraphs, telephones, electric transits, etc. It is intended that the spacious grounds shall be laid out as a park, portions being reserved for the exercise and recreation of convalescents, and other portions for those who come from an infected ship or locality but exhibit no symptoms of the disease, and who, of course, are most likely to be impatient under detention.

Quarters should be provided for those in the main building, and every practicable arrangement made to render their sojourn as pleasant as possible. The whole establishment should be located in as attractive and healthful a site as possible, and given as much the air of a summer health resort as may be consistent with the purposes for which it is destined.

The main building would be the place at which all information should be centred, and from which all authority should emanate. Here would be the head-quarters of the medical staff; and here the knowledge acquired at the bedside would bear its fruits. Here should be kept models and designs for building; here should be exhibited the highest standard of cleanliness; here should be formulated sanitary rules. Each subsidiary department should be complete in itself.

The working of such an establishment would be something like this:

On the appearance of a case of cholera anywhere, or the landing of passengers from an infected ship or other locality, the staff would be immediately communicated with. At once officers would be dispatched to remove the infected or suspicious persons, to investigate the circumstances thoroughly, and take all necessary measures. The very presence of these officers, and the knowledge that the matter was being promptly and efficiently dealt with, would quiet alarm.

If I may use a familiar comparison, it would resemble the introduction of the modern fire department into our city. I can remember when Baltimore was protected only by volunteer fire companies, with hand-apparatus. Many of these firemen were brave and devoted men, but there was no proper organization, no discipline, no efficient appliances. They worked at random, and at a disadvantage. Any one who chose might offer his advice or his services, and this well meant zeal was often a hindrance rather than a help. The consequence was that a large fire spread alarm over the city. Now that we have a thoroughly organized department, with experienced chiefs, improved apparatus, and thorough drill, the fire alarm scarcely causes a ripple of excitement. Every one knows that whatever can be done will be done, and that the whole business is in the hands most competent to manage it.

The practical advantages of such a system as I have described may be summed up as follows:

1. It would prevent panic; for nothing could be more reassuring to a community than the knowledge that there was such a body of men at all times ready to meet the first appearance of disease, and thoroughly provided with the means to cope with it.

2. It would give the greatest facility for preventing the outbreak of an epidemic and subduing the germ if it made its appearance.

3. It would give the best possible facility for the recovery of patients attacked, by combining the most effective medical treatment with the most perfect possible sanitation.

It is, therefore, eminently the proper thing, and the right time now, that the state, municipal, and federal governments of the world should unite, and by utilizing the collected treasures of knowledge, show to the world the needed pleasant and happy quarantine of the future.

I am aware of an objection that may be raised to my plan. It may be said that if it succeeds—if communicable diseases be stamped out or reduced to a minimum, our staff of trained physicians and assistants will have nothing to do. I answer, that I would make the institution which has been proposed the permanent centre of hygiene for the whole state. Now, hygiene and sanitation never rest; they are always furnishing new occasions for deliberation, investigation, and action. Sudden outbreaks of typhoid, of diphtheria, of the more malignant types of zymotic diseases, can often be traced to local or preventable causes. In such cases as these—and they are constantly occurring—our staff would be called upon. Many other cases will occur to you, which I need not suggest. I think that in denominating the institution a permanent centre of hygi-

ene I meet the objection fully. Besides preventing panics, and giving every possible chance for promptly subduing and curing cholera and yellow fever, this advanced and elevated treatment of these diseases will have a tendency to change or reduce their management from a rough and pestiferous detention, to an enlightened and agreeable attendance upon the advanced laws of the treatment and prevention of communicable diseases. This change, I think, is due alike to the unfortunate patients themselves, and it will be by far the best policy for the public.

It is peculiarly fitting that a paper upon quarantine should come from this convention at its meeting in Mexico, because from the confines of the Spanish speaking governments comes one of the most deadly of the quarantined diseases—yellow fever, which disease, it has been proved, may be prevented by proper sanitary care, and can also be prevented from entering another country by such a quarantine as has been here delineated.

XLV.

CONTAGIOUS DISEASES ON THE RIO GRANDE BORDER.

By Dr. W. M. YANDELL, Health Physician,

El Paso, Texas.

El Paso had by the census of 1890 over 10,000 population; Juarez, Mexico, has a population estimated at from 6,000 to 10,000, no census having been taken. The cities are separated by the Rio Grande river, which is either not running or is low enough, for several months in the year, to be easily waded, and is spanned by two combined street-car and wagon bridges.

The following table I have compiled from the official records of the two cities. Under the head of "Diphtheria, etc.," I include scarlet-fever and croup. There were but few deaths from either, and croup is included on account of the liability of non-professional persons to confound it with laryngeal diphtheria.

	El Paso.				Juarez.			
	1889	1890	1891	Total.	1889	1890	1891	Total.
Diphtheria, etc.	8	4	3	15	61	25	13	99
Small-pox	1	6	1	8	14	35	0	49
Grand total				23				148

For the three years Juarez shows a death-rate, from contagious diseases, six and one half times greater than El Paso. Dr. Jesus Chico, of Guanajuato, Mexico, in his paper on "Diphtheria in the Mexican Highlands," in Transactions American Public Health Association, Vol. XVII, p. 206, says,—

"We physicians, now well aware of the possible danger, take every personal precaution we can, and admonish seriously the families to take the required measures; but in the immense majority of cases they give no heed to our advice, partly on account of their not being sufficiently educated to acknowledge the necessity of the sacrifices required, and partly because experience has shown them that the danger of contagion is a very remote one. The walls are neither scratched out of their first

layers nor whitewashed; furniture, dresses, and bed-clothes are not burned, and the brothers and sisters of the patient do not discontinue their attendance at school."

Dr. Chico also says that in Guanajuato they "have had several small epidemics which vanish without any effort to check them."

What is quoted above is true as to this border, and might be said of small-pox, almost as well as of diphtheria.

In El Paso the maximum penalty for failure to report a case of contagious disease is a fine of one hundred dollars, and thirty days in jail; isolation of the sick; discontinuance of attendance on schools, churches, and public assemblies by other members of the family; private funerals, disinfection, etc., are rigidly enforced.

There had been no small-pox of any consequence on this border for several years prior to 1889, and for this reason I commenced with that year, in preparing the table.

Diphtheria is perennial in the Mexican villages on this border, and in the village of Socorro, sixteen miles below El Paso, in Texas, with a population of eight hundred, all Mexicans, there were twenty-three deaths from diphtheria in one month in the spring of 1891.

Small-pox killed sixteen more of the unfortunate villagers within two months in the same spring. In other words, Socorro with eight hundred people had thirty-nine deaths from diphtheria and small-pox in three months, while El Paso, with over ten thousand population had twenty-three deaths from the same diseases in three years, and of these fourteen were Americans and nine Mexicans, though the Mexicans constitute but about one fifth of El Paso's population. It should be said that the Mexicans make up nine tenths of the city's poor, and that they are almost universally poor, but on the other hand their utter disregard of all precautions to prevent the spread of contagious diseases, except from fear of the law, is not questioned.

The startling facts above set forth could be easily multiplied, in fact I am not afraid to say they can be duplicated in every Mexican village on this border.

The Mexican government has passed the necessary laws for protecting the public health, and many Mexican physicians are alive to the importance of enforcing them, but the masses are to be taught by the strong arm of the law only. Laws for the protection of the public health are, except in our Mexican communities, more strictly enforced in our country than in Mexico, because the masses in our country fear contagious diseases, while the masses in Mexico do not. That there is room for great improvement in sanitary matters in our own country is not denied, but we of El Paso are endeavoring to educate the villages round about in Texas, and with some success. Only by looking the truth in the face can we go forward, and while the facts in the foregoing are not pleasant to contemplate they are *facts* nevertheless.

XLVI.

A MODIFICATION OF INNER-QUARANTINE REGULATIONS, AS ESPECIALLY APPLIED TO EPIDEMICS OF YELLOW-FEVER.

By D. B. BLAKE, M. D., Health Officer,

Cuero, Texas.

In presenting the plan herein proposed, it may not be improper to state that the subject-matter was written up some two years since for presentation to the surgeon-general of the United States, but was never forwarded.

And it is proper that I further premise by saying that the term inner quarantine is used as in contradistinction to outer quarantine: the first being understood to apply to the system which is practised in the effort to hold the epidemic within certain definite limits after it has obtained a footing on the main land; the latter to that system which obtains in holding the disease in the offing. With this latter this paper does not treat.

The principle of the quarantine, Mr. President, is good; its results have sustained the expectations of its advocates: no candid observer will venture to assail it. And yet, like other beneficent institutions, it is susceptible of improvement. And when we, as an association, working together for the noble Christ-like purpose of doing good to our brother-man, have succeeded in any measure in mitigating some of the evils resultant from efficient quarantine, we have added to that efficiency and have taken a stride forward in popularizing this defensive sanitary regulation.

Many hundred years was the great Chinese wall in building, for the purpose of keeping back the northern hordes from China's fair fields. Many hundred years we have been coming to our present status in quarantine science. The need for the one has ceased to exist; it merely stands a monument to man's energy. The other is yet in process of building, and every idea placed therein, that tends to its final perfectionment, is in line with the work of this Association. I have come, Mr. President, with what I confidently believe is such an idea, as an offering for this cause. True, sir, in the onward march of science, fostered and stimulated by this and kindred associations, we may arrive at a period when, like the Chinese wall, quarantine will become a relic, while the microbic hosts are reduced to compliant servitude in the great domain of the "healing art." This in confident anticipation; but till that good day

arrives, let us bestir ourselves in utilizing this protective wall to the greatest advantage, and yet with the least hurt or injustice to the distressed and afflicted.

In the maintenance of an efficient inner quarantine during an epidemic of yellow-fever, the citizens of the infected zone must remain exposed to the disease, or run the gauntlet of the 15 and 20 days' quarantine detention. To many this latter is more distressing than the risk of taking the disease. At best the station is but a hurriedly constructed and unsatisfactory arrangement; in the nature of the case it cannot be otherwise. And here delicate females, children and all, are thrown into camp and subjected to vicissitudes of weather that cannot be foreseen. Worse, they are in intolerable mental distress at being in such manner detained. For you will readily understand, sir, that they live in daily apprehension of the disease appearing in this camp, and then comes removal to another, and possibly another, ad infinitum; or the principle of efficient quarantine must be violated, by permitting persons who have been in dangerous proximity to depart without due and consistent reference to the time limit.

Again: this disease we may say invariably first appears in some of our sea-port towns; the quarantine camps are located contiguous thereto; this insures the camps or stations being in a low, insalubrious region, in almost all instances. So, though the disease from which the refugee flees does not here overtake him, yet is he in imminent danger from some form of paludal fever, which sometimes is not one whit short of "yellow jack" in point of fatality.

Then let us consider how much is added to the difficulty of maintaining efficient quarantine under such circumstances. See it as depicted in the public press, during the epidemic in Florida some years ago. The people cannot be held within the quarantine lines; they filter through, spread abroad through the regions beyond, carrying with them, possibly, the seed germ that is to become a new focus.

To better this condition, let us proceed to consider the following simple plan:

High up on the mountain chains of our respective states there are beautiful healthful plateaus; on these one or more permanent quarantine stations might be established, kept and maintained by our general governments. Being placed under military control, they may be made military posts. Here can be erected all needed buildings for the accommodation, comfort, and sanitary protection of the refugees, as also for the disinfection of baggage, etc., and for the study and investigation, scientific and clinical, of this as yet imperfectly understood disease. An outbreak of yellow-fever occurring, the citizens of the afflicted district are urged to, as far as practicable, desert their homes and flee to this "city of refuge," there to remain the prescribed limit, when they are given certificates and sent on their way. Confidence is thereby restored, and the citizen comes to aid rather than to curse and dodge the quarantine. The material upon which the disease would feed is removed from its reach; it

cannot follow and live. As a result, the epidemic is at an end—is held in abeyance till the coming of "white jack" (frost) effectually puts an end to "yellow-jack fever."

This, Mr. President, is the plan; simple, yet difficult. Should this Association deem it practicable, worthy, and to be desired, then comes the matter of detail, and afterwards the adoption and execution by our several governments. In this there will arise complications and difficulties.

It may clash with the peculiar rights and prerogatives of state sovereignty in republican governments. The passing of quarantine trains, though under guard, through cities and towns to reach these permanent stations, may arouse antagonism; other contingencies will arise; but let us not now be concerned over-much for these. The rather, let us determine if there be the necessity for such an undertaking. Should this Association so decide, then may we not take to ourselves the flattering assurance that we can set in motion influences which will overcome all obstacles? I confidently so believe.

XLVII.

THE SANITARY RELATIONS OF TEXAS AND MEXICO, AND THE OFFICIAL CORRESPONDENCE RELATING THERETO.

By R. M. SWEARINGEN, M. D., State Health Officer of Texas.

The recent achievements of sanitary science have surpassed the expectations of the most sanguine, and have paved the way to broader fields of usefulness.

The almost perfect system of maritime sanitation, inaugurated by Dr. Joseph Holt, that has for a decade protected New Orleans and other southern ports from yellow-fever without materially locking the wheels of commerce, and the successful measures enforced within the last few months in New York against cholera, have strengthened the belief that we can control and exclude exotic diseases.

Reasoning by analogy and in light of the discoveries that epidemic diseases are caused by germs susceptible of cultivation and attenuation, we are furthermore warranted in the conclusion that vaccination will be the great preventive remedy of the future. But this knowledge of protection given by vaccination is confined almost exclusively to the medical profession. The masses of the people, both in the United States and in Europe, and especially in the republic, Mexico, are in ignorance of the simplest principles that underlie the great science of preventive medicine. A duty imperative upon us as sanitarians is their enlightenment upon these principles; they should be taught how *to not be sick*, and made acquainted with the fact that one fourth of all the deaths over the world are the result of causes easily preventable; they should know that science is doing all that human agency can do toward the eradication of these diseases, and yet, without this knowledge on their part, and their sympathy and co-operation in the application of sanitary principles, the best labors of the great investigators will avail nothing.

At present we are concerned more especially with small-pox. In some parts of Europe, notably in Ireland, the peasantry are in profound ignorance of the benefits of vaccination, or are incredulous and will not accept it if offered, and still resort to the inhuman practice of purposely exposing their young to the disease for future protection, believing that it is less fatal with children than with adults. And to-day, while the advanced sanitarians of Mexico are in the forefront of sanitary progress and enlightenment, the peasantry of that country are as benighted as though Jenner had never lived, nor Pasteur made a discovery. I am

reliably informed that small-pox is endemic in many of the rural districts, and that the opportunity to secure vaccination is the exception, and is rejected if offered—the ignorant still adhering to the practices, traditions, and customs of their ancestors;—esteeming it a virtue to have had the disease in childhood, they will purposely expose their young to the infection. Small-pox is thus purposely propagated and perpetuated; and Texas, by reason of her proximity and the natural close social and commercial relations of the two countries, is the sufferer. The health officials of Texas have no means of knowing when or where the disease is prevailing in Mexico; therefore we are powerless to prevent the introduction of the infection into our lines, unless we assume that the whole country is infected and exclude all. In nearly every instance where small-pox has made its appearance on our western border it has been introduced from Mexico. In many instances an American citizen visiting Mexico, more especially in the winter, will, within a few days after his return, startle his neighborhood by developing a case of small-pox. The state of Texas, with a border-line of hundreds of miles confronting the republic of Mexico, is, of course, more exposed to invasions of this kind than are all the other states combined. The intimate business, social, and domestic relations between the two peoples living on the opposite sides of the Rio Grande, must necessarily endanger both, when either is afflicted with contagious or infectious disease; and a defence for one side must be a defence for the other.

Texas is doing all in her power to protect her people; but unless a corresponding effort is made on the other side, it is absolutely impossible to eradicate the disease; and our experience of last winter and winter before, when we had one thousand nine hundred and three recorded cases of small-pox, with a total of four hundred and sixty-four deaths, and expended for hospital purposes alone, $150,000, may be repeated year after year indefinitely.

That some idea may be had of the expense attending an outbreak of the disease I will mention that the official report made by Dr. Braunagle, the city health physician of San Antonio, to the state health officer shows that in the period covered by said report—the winters of 1890–'91–'92—there were 1,109 cases treated in that city and vicinity, with 300 deaths, and at a cost of $19,541.85.

We think that under these circumstances Texas has a right to protest, and does protest against a perpetuation of these impending evils.

The knowledge that small-pox is frequent in the rural districts of Mexico in proximity to the Texas border, and knowing the great repugnance the Mexican laboring classes have for vaccination, believing, too, that very little was being done by the Mexican government to arrest its progress,—it was not difficult to realize the danger which threatened the public health of Texas from that source. Accordingly, as state health officer of Texas, I ordered certain restrictions on persons and things coming direct from Veracruz, Tampico, and Tuxpan, on account of yellow-fever, and also instituted an inspection service of all

the trains entering the state from Mexico, on account of small-pox. Upon the promulgation of the rules, his excellency, Señor Romero, the Mexican charge d'affaires, addressed a letter of remonstrance to the secretary of state at Washington as follows:

LEGATION OF MEXICO,
WASHINGTON, September 3, 1891.

Mr. Acting Secretary:

Inasmuch as the quarantine which the state of Texas has established against the Mexican ports of Veracruz, Tuxpan, and Tampico, is very prejudicial to commerce and to the trade between the two countries, especially to the commerce of the last named port, where it is well known there is no epidemic, as is proved by the list of deaths which occurred in that port during the month of June and the first half of July last (of which list I have the honor to transmit you a copy), and as the authorities of Tamaulipas have taken the preventive measures of sanitary police, the department of foreign relations of my government directs me to take the necessary steps in order that the state of Texas may, if possible, raise that quarantine, so far as goods and people coming from Tampico are concerned, and in order that it may be less severe in its international sanitary provisions, which are not thoroughly justified, since in other respects they are unnecessarily prejudicial to the commerce and the relations between the two countries.

I shall be obliged to you if you will kindly present these views to the governor of the state of Texas, and I entertain the hope that when that officer shall once be convinced that there is no epidemic in Tampico, he will be pleased to take the course which the government of Mexico suggests. I avail, etc.,

C. ROMERO.

This letter of remonstrance was forwarded to Governor Hogg by the acting secretary of state at Washington, accompanied by the following note:

DEPARTMENT OF STATE,
WASHINGTON, September 8, 1891.

To His Excellency, the Governor of the State of Texas, Austin:

SIR: I have the honor to enclose for your information a copy of a note from the charge d'affaires *ad interim* of Mexico, of the 3d inst., stating, at the instance of his government, that the quarantine which the state of Texas has established against the Mexican ports of Veracruz, Tuxpan, and Tampico, is prejudicial to the commerce and to the trade between the two countries. He accordingly asks, that in view of the fact that no epidemic exists in Tampico, the quarantine may be raised.

I have the honor to be, sir, your obedient servant,

[Signed] WM. F. WHARTON,
Acting Secretary.

Enclosure: From Mr. C. Romero, Sept. 3, 1891.

The foregoing correspondence was referred to the state health officer, and in reply to the objections of Señor Romero I had the honor to address the governor of Texas the following letter:

AUSTIN, Sept. 13, 1891.

His Excellency, the Governor of Texas:

SIR: The letter of the honorable acting secretary of state, William F. Wharton, dated September 8, enclosing a note from the charge d'affaires of the republic of Mexico, C. Romero, concerning the quarantine of this state against Tuxpan and Tampico, and

referred to this office by your excellency September 12, I have the honor to acknowledge.

The quarantine against Tampico and Tuxpan, notwithstanding their freedom from yellow-fever, was, in my judgment, justified, because both of the towns named were in direct and frequent communication—one by water and the other by rail and water—with Veracruz, a badly infected city. I have no reliable official channels for receiving information from Tampico, and an epidemic could be progressing there for weeks before the knowledge of its existence reached me. We all know that citizens of infected places are slow to admit their infection, and very slow in giving publicity to it. In matters of such vital interest to our people, I cannot afford to take risks to please a few merchants and tourists, nor can I rely upon defences made by a people who denounce quarantines and repudiate vaccination.

With respectful deference to the statement made in the communication of Minister Romero, that the authorities of Tamaulipas have taken preventive measures of sanitary police, I know that Tampico has not had quarantine, nor even an inspection service against the city of Veracruz this summer; the health authorities of Tampico claiming, that "by reason of their cleanliness, epidemics could not prevail there."

No one familiar with yellow-fever could endorse a theory so inconsistent with every page of its history, and no one familiar with Mexican coast towns would be likely to look among them for ideals of cleanliness only dreamed of by modern sanitarians.

If, however, we grant for argument, that the health authorities of Tampico have attained a sanitary perfection that gives exemption from epidemics, we can yet give good reasons for maintaining the quarantine complained of.

The railway time between Texas, where we have no sanitary Utopias, and Tampico, is about fifty or sixty hours. The citizens of Tampico will probably admit, that it is possible for a vessel to arrive in their port from Veracruz or Cuba with yellow-fever on board. The good people of Tampico, emboldened by the teachings of their health authorities, could, without hindrance, visit the ship, and could, but for our quarantine restrictions, come directly on to Houston or Galveston, and even continue the journey to New Orleans before the development of fever gave evidence of their exposure to infection.

I could present to your excellency other reasons for interrupting the commercial relations between this and our sister republic, but believe enough has been written to clearly demonstrate the necessity of a course of action so much regretted by all of us.

Science has not yet formulated a defence against contagious and infectious diseases more reliable than that of quarantine, and until higher lights fall upon us, commerce must be sacrificed in the interests of public health.

In conclusion, I beg leave to venture the suggestion, that these and other quarantine annoyances must necessarily embarrass our international relations, until a wise system of rules, requiring uniform quarantines and general vaccinations, shall be adopted and enforced by both governments. I have the honor to be

Your obedient servant,

[Signed] R. M. SWEARINGEN, M. D.,
State Health Officer of Texas.

EXECUTIVE OFFICE,
AUSTIN, TEXAS, Sept. 15, 1891.

Hon. Wm. F. Wharton,
Acting Secretary of State,
Washington, D. C.:

DEAR SIR: I have the honor to acknowledge the receipt of your courteous favor of the 9th inst., enclosing to me for information a copy of a note from the charge d'affaires *ad interim* of Mexico, of the date of the 3d inst., stating at the instance of his government, that "the quarantine which the state of Texas has established against the Mexican ports of Veracruz, Tuxpan, and Tampico is very prejudicial to commerce and to the trade between the two countries."

I submitted the two letters to our very efficient and worthy state health officer, Dr. R. M. Swearingen, and beg to hand you herewith a copy of his reply thereto.

It is with much regret that the state of Texas is forced, by the apparent inadequacy of the quarantine regulations in the republic of Mexico, to resort to rigorous measures in the protection of her own citizens against contagious and infectious diseases originating at the ports named.

As a solution of the trouble, I beg to suggest that should the health officers of Vera-cruz, Tuxpan, and Tampico be willing to meet those in charge of the quarantine affairs of our state at some convenient point, I shall cheerfully have every measure taken by the Texas authorities to make the conference satisfactory and successful. With great respect, I have the honor to be

Your obedient servant, etc.,

[Signed] J. S. HOGG, *Governor.*

DEPARTMENT OF STATE,
WASHINGTON, November 30, 1891.

His Excellency, the Governor of Texas:

SIR: Referring to your letter of 15th September last, relative to the quarantine established by Texas against the Mexican ports of Vera Cruz, Tuxpan, and Tampico, I have the honor to enclose a copy of a note from the Mexican minister here, by which it appears that the conference, suggested by you, between Health Officers of Mexico and Texas is accepted, and an inquiry is made as to the time of meeting. I have the honor to be

Your Excellency's obedient servant,

[Signed] JAMES G. BLAINE.

MEXICAN LEGATION,
WASHINGTON, November 23, 1891.

MR. SECRETARY: I have the honor to inform you, referring to the note addressed to this Legation by the Department of State on the 21st of September last, on account of the complaint occasioned by the quarantine which authorities of Texas established against the Mexican ports of Vera Cruz, Tuxpan, and Tampico, that the matter having been submitted by the Department of Government of the Government of Mexico to the Superior Board of Health, that corporation recommended the acceptance of the suggestion of the governor of the state of Texas, contained in the note which he addressed to your Department on the 15th of said September, and which Mr. Wharton forwarded to this Legation with his above mentioned note of the 21st of the same month, that a conference be held between Health Officers appointed by the Government of Mexico on the one part, and by others of the same character of the state of Texas, for the purpose of considering the proper means for avoiding the propagation of yellow-fever between the said state of this country and those of Vera Cruz and Tamaulipas of the Mexican republic.

For this reason, and the government of Mexico having approved the recommendation of the Superior Board of Health, I beg you to be kind enough to inquire of the governor of the state of Texas where and when he thinks it proper that the Health Officers of the state of Texas should meet those whom the government of Mexico may designate, in order that this meeting may take place as early as convenient. Accept, Mr. Secretary, etc.

M. ROMERO.

AUSTIN, January 27, 1892.

Hon. Walter Wyman, M. D.,
Supervising Surgeon General,
Marine Hospital Service:

DEAR SIR: By the enclosed correspondence, you will see that a proposition from His Excellency the Governor of Texas, to the government of Mexico, to have an international conference, "for the purpose of formulating a co-operative quarantine on the Rio Grande,

and at the Gulf Ports," has, through His Excellency Secretary Blaine, been formally accepted, and the time and place of meeting left entirely with the governor of Texas.

As the conference will assume the proportions and dignity of a sanitary treaty between two governments, and as you represent our national quarantine, your presence in that conference will, in my judgment, be essential to its success.

The polite relegation by the Mexican authorities, of the questions of time and place, to the governor of Texas, by common ethics would necessitate the reciprocal courtesy on his part, of selecting the city of Mexico, or some city in Mexico, as the place of meeting.

The plan of co-operative quarantines that we hope to inaugurate with our sister republic, may pave the way to still greater things, and, further on, embrace the states of Central and South America, and all the islands of the yellow-fever zone.

If we can secure the adoption of efficient systems of rules, that can be enforced at every yellow-fever port, and at every port where yellow-fever may possibly exist, and have reliable channels for obtaining prompt information (the *government giving the information* becoming responsible for its correctness), we will be in position to not only strengthen our commercial relations with southern countries, but we will be able to give assurances of protection against the introduction of infectious diseases.

I most respectfully but urgently invoke your assistance in this undertaking, and trust to have at an early date, your views and suggestions concerning it. I have the honor to be

Your obedient servant,
R. M. SWEARINGEN, M. D.,
State Health Officer of Texas.

TREASURY DEPARTMENT,
OFFICE OF THE SUPERVISING SURGEON-GENERAL,
MARINE HOSPITAL SERVICE,
WASHINGTON, D. C., March 9, 1892.

Dr. R. M. Swearingen,
State Health Officer of Texas,
Austin, Texas:

DEAR DOCTOR: Acknowledging the receipt of your communication of January 27th together with copies of the correspondence between the governor of Texas and the secretary of state, and between the latter and the minister of Mexico, and relating to an international conference for the purpose of formulating a co-operative quarantine on the Rio Grande, and at the Gulf ports, I have to say that I will be glad to render whatever aid is in my power to further the matter in question. So far as time and place are concerned it would be impossible for me to join such a conference before the adjournment of congress, and the most convenient time would be when the American Public Health Association meets in the city of Mexico, which will be in the fall. I will be obliged to be in Mexico at that time, and it would be impracticable for me to make two trips to that city within the year.

I would be glad to have from you a statement of the propositions that you expect to make to the Mexican government, and I will be better able then to state what part in the sanitary agreement the national government can take. It seems to me that we have a great deal to demand of Mexico. I would suggest, so far as maritime quarantine is concerned, an agreement which would forbid the granting of clearance papers to any ship bound from the port of one country to any port in another during the quarantine season, unless such ship has a clean bill of health, but that acceptance of this bill of health by the United States authorities should not be compulsory.

With regard to border quarantine, I believe that the chief feature of co-operation would be the inter-notification with regard to the prevalence of disease.

I am in receipt of a letter within the last week from Senator Chilton, of your state, calling attention to the necessity, as set forth in a letter from Honorable John J. Dix, of maintaining stricter quarantine along the border to prevent the ingress of small-pox into

Texas, and secondarily, into other states of the United States. I have replied to his letter in brief, that the present laws permit action by the United States authorities, either to enforce regulations of their own or to enforce those of the state of Texas, and that the chief object of solicitude at the present time is to keep the epidemic fund, from which the expenses of such service is paid, up to a sufficient amount to meet any possible emergency.

Please let me hear from you with regard to the two points mentioned; first, the propositions you will present to the Mexican government, and, second, whether the time of meeting in Mexico will be satisfactory to yourself.

Very respectfully yours,

[Signed] WALTER WYMAN,

Supervising Surgeon-General, M. H. S.

The correspondence between the surgeon-general of the Marine Hospital service of the United States and health officer of the state of Texas terminated with the above letter.

There is no provision in law, and no precedent of my knowledge, that clothes a state official with power to enter into agreements with foreign governments, or to formulate any kind of rules that could be made binding upon either.

On account of this construction of law, and other reasons, it was thought best by the governor of Texas to postpone further action until the present meeting of the American Public Health Association, and refer the whole subject to this distinguished body.

In conclusion, I respectfully submit that the co-operative measures suggested in the correspondence above referred to, can have neither strength nor efficacy unless they rise to the dignity of a sanitary treaty, entered into by duly authorized commissioners of the two great republics of America.

XLVIII.

MEDICAL DEMOGRAPHY.

By W. A. HASKELL, A. B., M. D.,

President of the Illinois State Board of Health,

Alton, Ill.

Medical demography is of peculiar interest to the sanitarian, since it deals with all factors that decrease and increase the race, like its natality, morbidity, viability, and mortality. The science, moreover, bears a peculiar relation to international sanitation, since through it will best be solved the problem whether and how far certain diseases, endemic among some races, can be prevented from becoming epidemic among others. In this problem is involved the now mooted question, how far certain microbes increase their pathogenic powers when transmitted from one race to another. A race, as Arnould has shown, becomes acclimated when it maintains its power of demographic expansion, its normal longevity, and its aptitude for mental and physical labor. The Aryan races inhabiting certain islands have been shown to possess all these qualities; yet when visited by ships bearing strangers, these seemingly robust islanders are seized by epidemic "colds." The visitors may be seemingly free from pulmonary or throat symptoms; still their advent results in an epidemic among the islanders. Every other explanation can be excluded but one—the visitors carry with them microbes which become pathogenic in the islands. The natives of these islands are simply a variety of the Aryan race, not differing greatly from their visitors in type; yet the harmless microbe of their visitors becomes a potent factor in disease production. Here is an excellent illustration of the fact that racial variation, within narrow limits, may produce constitutional changes sufficient to render a harmless microbe pathogenic by affording the special soil on which it can work.

That the microbe should so vary with different races, is in full accord with certain general laws. Parasites, much higher than microbes in the scale of evolution, vary, as Darwin and other ethnologists have shown, with the race they infest, the difference being almost specific in type. It follows from this that a mild disease in one race may become virulent in others by the process of cultivation. An excellent illustration of this is the bubonic plague. This, as Hecker has shown,[1] was a disease "marked by inflammatory boils and tumors of the glands." On account

[1] Epidemics of the Middle Ages.

of these boils, and "from the black spots, indicative of a putrid decomposition, which appeared on the skin, it was called in northern Europe the 'black death.' In many cases black spots broke out all over the body, either single or united and confluent." This disease, which some have erroneously confounded with small-pox, prevailed in frequent epidemics in western Europe from the time of Thucydides until early in the eighteenth century. Although this bubonic plague still exists in Turkey, although there is greater intercourse than there was in the fourteenth and fifteenth centuries, when the epidemic swept through Europe, still the bubonic plague remains practically endemic in certain regions, and does not spread beyond them. The ravages of the fifteenth century epidemic led to a Venetian health board and to quarantine precautions with bills of health, which, however, did not become general until late in the seventeenth century, just previous to the bubonic plague which devastated London. That quarantine alone failed to extinguish the plague epidemics, no careful student of sanitary history can doubt; but there can be no doubt either that it ceased, after the early eighteenth century, to appear in Europe.

One circumstance is so coincidental with the appearance of epidemics as to deserve recognition as an aetiological factor: every epidemic was preceded by an Asiatic inroad upon Europe, or its equivalent repulse. Coincidentally with the cessation of these inroads, came the cessation of the bubonic plague in Europe. The plague is practically an endemic in Russia and Turkey, and is often very mild in type. After cholera epidemics it, however, often assumes the old type, but it does not invade western Europe. An instance the converse of this, is shown in the history of dengue in Europe. This at one time was exclusively confined to the Mediterranean; littoral, and sub-tropical at most, in character, it is now beginning to invade the temperate zone. Instances like these indicate, that with the influx of races into new regions the diseases of those races are propagated, as well as others which are unknown to the races bringing them. It is of interest, therefore, to determine what race factors enter into race morbidity.

It has been claimed by Dr. Felkins and others, that man living in a wild state has a different constitution from the man living under conditions of high culture; the latter inducing nervous impressions which lower vital energy, and an artificial environment which lessens corporeal resistances; civilized man thus becomes more prone to inroads of septic disease which can be successfully withstood by lower races. It is quite possible that the power to eliminate poisonous products is greater in uncivilized than civilized races. It is certain that there are individual peculiarities in the composition of the blood and its relation to tissue changes, and in metabolic activity, which give the lower races an advantage over the higher; the latter having become, through inherited civilization, the unfortunate possessors of a fitting soil for septic infection.

Races vary in different parts of the world in mental and physical characteristics, in their liability to suffer from various diseases, in the effects

wounds have on them, and in their power of bearing pain. Civilization, by making a race less hardy, increases sensitiveness to pain and liability to the power of sepsis. Careful research has disproved this alleged insensibility of the lower races to contagious diseases like measles, which, feebly fatal in the adults of the Semitic and Aryan races, sweep off multitudes among the Mongolian, African, and American races. Furthermore, researches among the defective classes show that these, like savages, have great power of bearing pain; indeed, sensitiveness to pain must, a priori, be regarded as a conservative factor, since such sensitiveness causes rapid attention to injuries, and hence their early repair. That the lower races are more easily affected by feebly contagious diseases, is shown by the differing history of leprosy in the Sandwich Islands and the United States; the Sandwich Islanders have been exposed to leprosy for less than half a century, and it is a frequent disease. Leprosy, with the annexation of Louisiana, came into the United States as a gift from the Acadians, who also left it as a gift to the Dominion of Canada. In neither of these two countries has it spread much beyond its original habitat. Even the leprosy introduced by the Scandinavians has spread but little among the allied races of the United States. The Chinaman, so fertile a source of leprosy to the Hawaiian, has not infected many American Anglo-Saxons. These facts are fully in accordance with what is known of epidemics among the defective classes. The alleged disease, insusceptibility of the lower races, is a myth based on Rousseau's cant anent the savage state, which survives too much in science. Dr. H. B. Holder has shown that much of the assumed health of the aborigines is a pure assumption.[1] Aboriginal races, therefore, have increased susceptibility to infectious diseases, which in them assume excessive virulence. Does this species of microbe culture lead to a disease becoming readily communicable and more virulent when a higher race is infected from a lower? That it does, the history of the widespread early sixteenth century epidemic of syphilis, following on the discovery of America, shows. Syphilis existed in Europe ere the discovery of America, but it did not assume an epidemic type until after that discovery. This syphilis epidemic was further characterized by, in many instances, "galloping tendencies." Such cases are rare, but not infrequently result in cases acquired by one alien race from another.

Since, as these instances show, diseases vary in virulence of type, and since, as the instances of plica polonica, beri-beri, and dengue show, diseases confined within moderate limits exhibit a tendency to spread beyond those limits, the study of indigenous diseases in their demographic aspect becomes as much a necessity for the international sanitarian as the study of zoönoses has been found for the political economist. Given a race inhabiting a hitherto isolated territory, which race finds itself in communication for the first time with a country extensively commercial; the question which interests intimately the sanitarians of

[1] Medical Record, 1892.

the latter country is, What are the diseases indigenous to that country, and what type do diseases from without assume in that country? Quarantine without such knowledge is likely to be either lax as regards its sanitary effect, or burdensome to commerce. Efficient quarantine, which aids, in lieu of injuring, commerce, is a desideratum. It cannot be attained, however, until the demography of a country becomes as much a matter of public interest as its commerce or its productions.

XLIX.

MEASURES TAKEN BY THE UNITED STATES MARINE HOSPITAL SERVICE TO PREVENT THE INTRODUCTION OF CHOLERA.

By WALTER WYMAN, A. M., M. D., Supervising Surgeon-General.

I have thought that it might prove of interest to give a connected account of the efforts made by the Marine Hospital service, during the recent threatened invasion of cholera into the United States, to prevent the same, showing both the independent action of the bureau and its service in aid of state and local boards of health. Long before the public press gave evidence of alarm over the cholera situation, it must have been evident to many of you, as it certainly was to myself, that the fearful outbreak of cholera in Persia and eastern Russia must soon imperil the United States. I may say that, as far back as October, 1891,—the cholera then prevailing in various provinces of Asiatic Turkey—the first special precautionary steps were taken by this bureau. The measures then taken consisted of a circular addressed to collectors and other officers of the customs, dated Oct. 19, 1891, requiring a disinfection at the port of Marseilles, of all rags imported to the United States from that port, it having been shown by the report of the able consul, Mr. Charles B. Trail, that rags collected in the infected districts were shipped to Marseilles for re-baling and re-shipment to the United States. The following is the circular:

IMPORTATION OF OLD RAGS FROM MARSEILLES.

1891. Department No. 162. Division of Customs.

Treasury Department, Office of the Secretary,
Washington, D. C., October 9, 1891.

To Collectors and other Officers of the Customs:

The act, approved April 29, 1878, entitled "An act to prevent the introduction of contagious or infectious diseases into the United States," provides that "no vessel coming from any foreign port or country where any contagious or infectious disease exists, nor any vessel conveying infected merchandise, shall enter any port of the United States, or pass the boundary line between the United States and any foreign country, except in such manner as may be prescribed under said act."

It having been shown that an epidemic of cholera prevails in various provinces of Asiatic Turkey; that old rags are collected in these provinces and shipped to Marseilles, France, there to be re-baled and re-shipped to the United States; that therefore rags from Marseilles, unless disinfected, are liable to import contagious disease into the United

States, and that, while the laws of the several states forbid the admission of infected merchandise, a want of conformity of the several state and municipal regulations may cause a laxity in the enforcement of restrictive measures; therefore, it is ordered that no rags imported from Marseilles shall be admitted to entry, unless accompanied by a certificate from the United States consul at Marseilles that they have been disinfected in accordance with the regulations of this department, or by a certificate to the like effect from a medical officer of the Marine-Hospital Service, or state or local quarantine officer.

This circular will take immediate effect, but will not apply to rags afloat on or before the date of its issue.

For disinfection one of the following methods will be used:

1st. Boiling in water not less than one hour, all rags to be unbaled for this purpose.

2d. Exposure to steam not less than one hour, the steam to be of a temperature not less than 100 degrees centigrade (212 degrees Fahrenheit), nor greater than 115 degrees centigrade (239 degrees Fahrenheit).

3d. Exposure not less than six hours to sulphurous acid gas, made by burning not less than three pounds of roll sulphur to each 1,000 cubic feet of space.

4th. Exposure not less than six hours to an atmosphere containing 3 per cent. of sulphurous acid gas liberated from its liquid state (liquid sulpur dioxide).

In methods No. 2, No. 3, and No. 4, the rags must be well scattered upon racks, or so arranged that they can from time to time be turned in such a manner that all shall be exposed to the steam or gas.

CHARLES FOSTER,
Secretary.

I will say that the object of this circular was two-fold.

1. As a preventive measure against the introduction of cholera; and

2. As the entrance point of a wedge which I hope to be able, ultimately, to drive home, permanently requiring disinfection abroad of all rags shipped from any port to the United States.

The rag question has proven in the years that are past, as well as during the past season, one of the most difficult sanitary problems for practical solution, and you are all familiar with the heated contests which have occurred, both at New York, Washington, and other ports, over this subject. The methods of disinfection required are fully set forth in the circular, and I had been informed by the consul at Marseilles that ample provision had been made by the shippers for disinfection of rags, but that while the health officer at New York was willing to enforce a foreign disinfection, the local health officers of the neighboring ports in New Jersey would not enforce it. The shippers themselves were entirely willing to comply with the sanitary demand, and at Marseilles had erected large disinfecting rooms for the purpose, but learning that it was not an absolute requirement they had abandoned the practice, and all rags were being admitted without disinfection.

The first circular referred only to the port of Marseilles, and, fortunately, raised no objection; and I believe that its provisions have been faithfully met.

Some six months subsequently, small-pox became prevalent in Ghent, Belgium. On the report of the consul of that place, showing the danger from rags, another circular was issued, May 12, 1892, requiring disinfection at Ghent of all rags shipped from that port. Some effort was made to break down this circular after the subsidence of small-pox, but

the protestants were informed that its provisions were intended to be permanent, and their acquiescence followed. Thus from at least two ports in Europe the requirement of consular certificates of disinfection became fixed and permanent. Later, when the danger of introduction of cholera became more imminent, the opportunity was seized to make the former circulars apply to all foreign ports, and a circular was issued August 19, 1892, requiring that rags from any foreign port, after September 20, 1892, would not be admitted into the United States without a consular certificate of disinfection, after the methods prescribed in the circular. The date, September 20, 1892, was fixed to give shippers an opportunity to provide the necessary plant for disinfection, and this same circular, August 19, provided further that rags gathered in, or shipped from, any port where cholera was known to prevail in epidemic form, should be denied entry to the United States absolutely, on and after the date of the circular, except such as were then afloat, which, however, were required to be disinfected on arrival. The circular of August 19th is as follows:

CONSULAR CERTIFICATES OF DISINFECTION REQUIRED WITH ALL IMPORTATIONS OF RAGS FROM FOREIGN PORTS—ABSOLUTE PROHIBITION OF RAGS FROM DISTRICTS KNOWN TO BE INFECTED WITH CHOLERA.

1892. DEPARTMENT No. 143. MARINE-HOSPITAL SERVICE.

TREASURY DEPARTMENT, OFFICE OF THE SECRETARY,
WASHINGTON, D. C., August 19, 1892.

The act approved April 29, 1878, entitled "An act to prevent the introduction of contagious or infectious diseases into the United States," provides that "no vessel coming from any foreign port or country where any contagious or infectious disease exists, nor any vessel conveying infected merchandise, shall enter any port of the United States, or pass the boundary line between the United States and any foreign country, except in such manner as may be prescribed under said act."

It having been shown that an epidemic of cholera prevails in Persia, India, and Russia, and that it has also reached Germany, Austria, and France, and in view of the danger which arises through the importation of rags from cholera-infected districts, and of the difficulty, through their reshipment at various ports, of accurately determining the localities in which rags are actually gathered:

Furthermore, because of the prevalence from time to time in various foreign countries of small-pox, scarlet-fever, diphtheria, and other contagious diseases liable to be conveyed by rags, therefore it is hereby ordered, that on and after September 20, 1892, rags from any foreign port will be refused entry into the United States unless said rags are accompanied by a certificate from the consular officer at the port of shipment to the effect that they have been disinfected in accordance with the methods herein described.

It is also ordered that rags gathered in or shipped from any port or place where cholera is known to prevail in epidemic form be denied entry to the United States *absolutely* on and after the date of this circular, except such as were then afloat, which must be disinfected on arrival. All previous Department Circulars relative to the importation and disinfection of rags, conflicting with the provisions of this Circular, are hereby amended to conform therewith.

For disinfection one of the following methods will be used:

1st. Boiling in water not less than one hour, all rags to be unbaled for this purpose.

2d. Exposure to steam not less than one hour, the steam to be of a temperature not less than 100 degrees centigrade (212 degrees Fahrenheit), nor greater than 115 degrees centigrade (239 degrees Fahrenheit).

3d. Exposure not less than six hours to sulphurous acid gas, made by burning not less than three pounds of roll sulphur to each 1,000 cubic feet of space.

4th. Exposure not less than six hours to an atmosphere containing 3 per cent. of sulphurous acid gas liberated from its liquid state (liquid sulphur dioxide).

In methods No. 2, No. 3, and No. 4 the rags must be well scattered upon racks, or so arranged that they can from time to time be turned in such a manner that all shall be exposed to the steam or gas.

O. L. SPAULDING,
Acting Secretary.

The enforcement of these provisions has been a matter not without difficulty. For a time the determination concerning cargoes of rags arriving, as to whether they were afloat at the date of the circular, was a matter of some nicety and occasional dispute, the most notable case being a cargo of rags from Germany held at the United States quarantine station at the Delaware breakwater. The vessel carrying these bales of rags, with other cargo, was detained for quite a period,—in the neighborhood of two weeks—and finally, in justice to the owners of the vessel, the rags were allowed to be transferred to two large barges and still held in quarantine, the vessel being fumigated and allowed to proceed to her port. The rags in the meantime, by reason of advance in prices, became very valuable, being worth about $10,000; but despite the repeated efforts of the agents they were held for several weeks, until under the claim that they were afloat before the date of the circular, and after arrangement had been made by the owners with the Philadelphia Board of Health, and an assurance had been received by myself from Dr. E. O. Shakespeare, the port physician, that their disinfection would be thoroughly effected at the lazaretto at Philadelphia, under his strict supervision and without danger to the public health, they were finally passed to the lazaretto, and are now undergoing said disinfection, the lazaretto being near the point of their ultimate destination. The importers of paper stock, including rags, members of the paper trade association, and other dealers have held meetings and appointed committees for the purpose of securing a modification of these regulations, their published proceedings reiterating the claims that rags are entirely free from all danger of carrying infection. During the coming month, by a special request, I am to have a conference with these several bodies, but I see no reason why the sanitary safeguard thus established should be broken down. Owing to the large amount of newspaper and other paper manufacturers in the United States, it is claimed that the home production of rags is sufficient to meet the demands of the trade. On the other hand, I have been assured that should foreign rags be absolutely prohibited, it would result in the development of a manufacture of a substitute for paper stock in this country, which would soon be sufficient for all purposes.

Having watched, doubtless in common with yourselves, the progress of cholera in the far East in the spring and early summer of this year,

and being convinced that through the channels of trade from these far-off countries the disease might at any time appear at our seaboard, on the 8th of July I caused the following circular to be issued, entitled "Vessels from Cholera-infected Districts to be Forbidden Entry unless provided with Certificates of Disinfection," describing the methods required: (*a*) Disinfection of Vessels; (*b*) Disinfection of articles of merchandise, personal effects, etc.

The following is the circular:

VESSELS FROM CHOLERA-INFECTED DISTRICTS TO BE FORBIDDEN ENTRY UNLESS PROVIDED WITH CERTIFICATES OF DISINFECTION.

1892. DEPARTMENT No. 112.

TREASURY DEPARTMENT,
OFFICE OF THE SUPERVISING SURGEON-GENERAL U. S. MARINE-HOSPITAL SERVICE,
WASHINGTON, D. C., July 8, 1892.

To Collectors of Customs, Medical Officers of the Marine-Hospital Service, and others whom it may concern:

The act, approved April 29, 1878, entitled "An act to prevent the introduction of contagious or infectious diseases into the United States," provides that no vessel coming from any foreign port or country where any contagious or infectious disease exists, nor any vessel conveying infected merchandise, shall enter any port of the United States, or pass the boundary line between the United States and any foreign country, except in such manner as may be prescribed under said Act.

Information has been received that cholera prevails in the Caucasus, in eastern European Russia, in Persia, in Calcutta, and on the western littoral of the Red Sea; and in view of the threatened further spread of the disease, and because of the danger which attaches to rags, furs, wool, hides, etc., which may have been gathered in the infected districts, and to articles of personal wear therefrom, it is hereby ordered that no vessel having rags, furs, skins, hair, feathers, boxed or baled clothing or bedding, or any similar article liable to convey infection, hailing from any port in the districts aforesaid, and no vessel from any port carrying the above mentioned merchandise or immigrants from the present infected districts or from districts that shall hereafter be officially declared infected, will be allowed entry to any port in the United States unless provided with either a consular certificate or a certificate from a medical officer of the Marine-Hospital Service, or state or local quarantine officer of the United States, to the effect that the vessel, cargo, personal effects, etc., have been disinfected in accordance with the methods herewith prescribed.

A.—DISINFECTION OF VESSELS.

The disinfection of the vessel must be in accordance with the most efficient quarantine practice, and will be by one or more of the following methods:

a. Bichloride of mercury.
b. Sulphurous oxide.
c. Steam heat.

In addition to the above, thorough cleansing, flushing with sea water, etc.

B.—DISINFECTION OF ARTICLES OF MERCHANDISE, PERSONAL EFFECTS, ETC.

For the disinfection of the articles of merchandise, personal effects, etc., mentioned in the circular, one or more of the following methods will be used, all articles to be unbaled:

1. Boiling in water not less than one hour.

2. Exposure to steam not less than one hour, the steam to be of a temperature not greater than 115 degrees centigrade (239 degrees Fahrenheit), and unmixed with air.

All bedding and clothing must be subjected to method No. 1 or No. 2.

3. Exposure not less than six hours to sulphurous acid gas, made by burning not less than three pounds of roll sulphur to each 1,000 cubic feet of space.

4. Exposure not less than six hours to an atmosphere containing 3 per cent. of sulphurous acid gas liberated from its liquid state (liquid sulphur dioxide).

5. Solution of carbolic acid of a 2 per cent. strength.

This method (No. 5) may be applied *only* to leather goods, such as trunks, satchels, boots, shoes; to rubber goods, etc., the articles to be saturated with the solution.

WALTER WYMAN,
Supervising Surgeon-General U. S. Marine-Hospital Service.

Approved by direction of the president:
A. B. NETTLETON,
Acting Secretary.

The provisions of this circular when carefully read will be seen to be very exacting, and they were made purposely so, with the intent of discouraging as much as possible all shipments from those countries, the disease not having at that period reached Germany and France. By request, the state department cabled to all its consuls abroad the terms of the circular, and from consular reports I was gratified to learn that it had resulted in an unwillingness on the part of shippers to send valuable cargoes of wool, and other materials which might convey infection, with the uncertainty of their being admitted entry into the United States. Its object was to discourage shipments, and this object was attained. Later, however, the cholera having appeared in various parts of Germany, Austria, and France, the prohibition caused by this circular was more exacting than could be reasonably enforced. The requirements of disinfection were now applied to a class of merchandise which was not contemplated at the time of its issue. I refer to boxed articles of manufacture, from which the danger was small, to the baggage and personal wear of first-class cabin passengers, which might be ruined by the process of disinfection required, large shipments of silks and other new goods, for damage to which the government was threatened with prosecution. Moreover, the general government, having control of but few of the quarantine plants on the North Atlantic coast, was not prepared to itself undertake the practical work of disinfection, which reasonably had to be left to the local quarantine authorities, the only alternative on the part of the government being absolute prohibition, which was impracticable. Therefore, another circular was issued later, September 7th, modifying the circular of July 8th to the extent of allowing such disinfection as might be satisfactory to the local quarantine officer, of special articles of merchandise and wear as could not be disinfected without injury after the methods described in the circular, provided his certificate should be furnished that these articles were not liable to convey infection, or were freed from all danger of being so in a manner satisfactory to himself.

The circular follows:

AMENDING DEPARTMENT CIRCULAR NO. 112, JULY 8, 1892, RELATIVE TO DISINFECTION.

1892. DEPARTMENT No. 158.

TREASURY DEPARTMENT,
OFFICE SUPERVISING SURGEON-GENERAL U. S. MARINE-HOSPITAL SERVICE,
WASHINGTON, D. C., September 7, 1892.

To Collectors of Customs, Medical Officers of the Marine-Hospital Service, and others whom it may concern:

Department Circular No. 112, July 8, 1892, entitled "Vessels from Cholera-infected Districts to be Forbidden Entry unless provided with Certificates of Disinfection" issued when the cholera prevailed only in Russia and the far East, is now hereby amended, and it is ordered that collectors of customs shall hereafter accept such other disinfection as may be required by the nature of special articles of merchandise and wear, provided a certificate is furnished by the quarantine officer at the port of arrival that said articles cannot be disinfected without injury after the methods described in the circular, and that they are not liable to convey infection, or have been disinfected and freed from all danger in a manner satisfactory to himself.

WALTER WYMAN,
Supervising Surgeon-General M.-H. S.

Approved:
O. L. SPAULDING,
Acting Secretary.

IMMIGRATION.

The danger accompanying immigration, on account of the cholera abroad, was so imminent as to excite, in the minds of all thoughtful sanitarians, the gravest fears. The appearance of cholera cases on board of a ship at an efficient quarantine station does not warrant a tithe of the alarm which should be felt over the hidden germ of the disease in the closely rolled packages of clothing of immigrants coming from infected districts, and carrying their personal luggage far into the interior. The disinfection, therefore, of all baggage of immigrants seemed to me a "consummation devoutly to be wished." And after becoming assured that a compulsory disinfection upon this side of the ocean was immediately impracticable, I caused to be issued a circular, dated August 17, 1892, requiring a disinfection abroad of personal effects and baggage of immigrants and others from districts infected with cholera.

The following is the circular:

PERSONAL EFFECTS AND BAGGAGE OF IMMIGRANTS AND OTHERS FROM DISTRICTS INFECTED WITH CHOLERA TO BE DISINFECTED AT PORTS OF DEPARTURE.

1892. DEPARTMENT No. 141.

TREASURY DEPARTMENT,
OFFICE OF THE SUPERVISING SURGEON-GENERAL MARINE-HOSPITAL SERVICE,
WASHINGTON, D. C., August 17, 1892.

To Collectors of Customs, Medical Officers of the U. S. Marine-Hospital Service, Agents of Foreign Steamship Lines, Local Quarantine Officers, and others whom it may concern:

The act approved April 27, 1878, entitled "An act to prevent the introduction of contagious or infectious diseases into the United States," provides that no vessel coming

from any foreign port or country where any contagious or infectious disease exists, or any vessel or vehicle conveying persons, merchandise, or animals affected with any contagious disease, shall enter any port of the United States, or pass the boundary line between the United States and any foreign country, except in such manner as may be prescribed under said act.

Furthermore, section 4792 of the Revised Statutes of the United States provides as follows:

The quarantine and other restraints established by the health laws of any state, respecting any vessels arriving in, or bound to, any port or district thereof, shall be duly observed by the officers of the customs revenue of the United States, by masters and crews of the several revenue cutters, ... and all such officers of the United States shall faithfully aid in the execution of such quarantine and health laws, ... and as they shall be directed from time to time by the Secretary of the Treasury.

Official information having been received of an epidemic of cholera in Russia, and in view of the large immigration into the United States from said country, and of the danger that exists of the introduction of cholera into the United States through the medium of personal effects and baggage of said immigrants, it is hereby ordered that on and after September 18, 1892, no vessel having on board personal baggage, bedding, clothing, etc., belonging to immigrants from Russia, or belonging to immigrants from any cholera-infected district, shall be admitted entry into the United States, unless accompanied by a certificate from the consular officer at the port of embarkation, to the effect that said personal effects, baggage, etc., have been disinfected in accordance with the methods hereinafter described.

For the disinfection of said articles one or more of the following methods will be used all articles to be unpacked and freely exposed for disinfection:

1. Boiling in water not less than one hour.

2. Exposure to steam not less than one hour, the steam to be of a temperature not less than 100 degrees centigrade (212 degrees Fahrenheit), nor greater than 115 degrees centigrade (239 degrees Fahrenheit), and unmixed with air.

3. Solution of carbolic acid of a 2 per cent. strength.

This method (No. 3) may be applied *only* to leather goods, such as trunks, satchels, boots, shoes; to rubber goods, etc., the articles to be saturated with the solution.

WALTER WYMAN,
Supervising Surgeon-General U. S. M.-H. S.

Approved:
O. L. SPAULDING,
Acting Secretary.

At the date this circular was prepared, cholera prevailed only in Russia, and the steamship companies were given until September 18th to prepare the necessary steam-disinfecting chambers, which would have to be constructed to carry out the provisions of the circular. In the light of what has since been achieved, it now seems an easy matter to make this requirement of steamship companies, but at that time it was an innovation which there was reason to believe might be resisted. The fixing of the date, September 18th, and the application of the requirement to immigrants from infected districts only, appeared to embrace all that was immediately necessary, or that might be successfully accomplished.

August 24th, however, cholera having, with a tremendous stride, appeared in Hamburg, a supplemental circular was issued, requiring disinfection abroad, of luggage and personal effects of immigrants from all European and Asiatic ports, whether infected or not, and declaring that the provisions of the circular should become operative immediately.

Circular follows:

PERSONAL EFFECTS AND BAGGAGE OF IMMIGRANTS FROM ALL EUROPEAN AND ASIATIC PORTS TO BE DISINFECTED AT PORTS OF DEPARTURE.

1892. DEPARTMENT No. 147.

TREASURY DEPARTMENT,
OFFICE OF THE SUPERVISING SURGEON-GENERAL MARINE-HOSPITAL SERVICE,
WASHINGTON, D. C., August 24, 1892.

To Collectors of Customs, Medical Officers of the U. S. Marine-Hospital Service, Agents of Foreign Steamship Lines, Local Quarantine Officers, and others whom it may concern:

Department Circular No. 141, dated August 17, 1892, relative to the disinfection of the personal effects and baggage of immigrants prior to embarkation, is hereby extended to include the baggage and personal effects of immigrants from all European and Asiatic ports; and it is further ordered that the provisions of the circular thus amended shall become operative on and after this date, except for articles of baggage, etc., afloat prior to the promulgation of this order, which must be disinfected on arrival.

H. W. AUSTIN,
Surgeon, M.-H. S., for the Supervising Surgeon-General.

Approved:
CHARLES FOSTER,
Secretary.

These provisions at once went into effect, and their enforcement has, I believe, in the main been effective.

Concerning the efficiency of the disinfection I shall have something to say further on.

Baggage for immigrants that was afloat before the issue of this circular, was required to be disinfected at the port of arrival, and not only *at* that time, but since, as a supplemental measure of disinfection of large quantities of baggage, has been successfully performed in the vessel's hold, where, a suitable room being made ready, through which the steam pipes of the steamers were conducted, holes being bored in the latter, the personal clothing was properly distributed, and steam thrown in in abundance from the vessel's boiler.

But despite this precaution it was felt that danger from immigration was still great. The loop-holes through which cholera might yet enter, in the company of immigrants, were numerous enough to still cause great alarm, and the thought that, should cholera once break out in the United States, while we, with all our peculiar American energy, might be successfully endeavoring to stamp it out, fresh importations were liable to come with every large ship-load of immigrants. This thought was both alarming and discouraging. The total prohibition of immigration, therefore, seemed to be a crying demand from a sanitary standpoint. In the meantime a popular demand arose that the president of the United States should suspend immigration, but there was no law of congress authorizing such a proclamation, and it appeared to me that reasons of state, in the absence of such a law, complications that would arise with foreign governments, might render such action of doubtful propriety. How then to stop this immigration without such a procla-

mation? In reading over the quarantine laws of the states, that have been collected and published by the state department, I found that every seaboard state had the right, under the laws, to enforce a quarantine detention of at least twenty days,—some states more—but there was no state which could not enforce at least twenty days. Under the national quarantine act of April 29, 1878, the general government is authorized to aid state and local boards, and the principle has been announced by the highest legal authorities, that while under existing laws the national government might not break down the quarantine barriers of a state, its power is unquestionable to add to those barriers when it becomes necessary. In other words, as tersely expressed by another, the state has the right to erect a ten-foot fence, but there is no law to forbid the United States from adding five feet to it.

Now, on account of the large expense entailed daily upon a huge ocean steamer, it was obvious that a quarantine detention of twenty days would be so costly that the steamship companies would be unwilling to undergo it; therefore, for the purpose of suspending immigration, and not with any idea of returning to the old Venetian quarantine, the following circular was issued, September 1st, approved by the secretary of the treasury and the president of the United States:

QUARANTINE RESTRICTIONS UPON IMMIGRATION TO AID IN THE PREVENTION OF THE INTRODUCTION OF CHOLERA INTO THE UNITED STATES.

1892. DEPARTMENT NO. 150.

TREASURY DEPARTMENT,
OFFICE OF THE SUPERVISING SURGEON-GENERAL U. S. MARINE-HOSPITAL SERVICE,
WASHINGTON, D. C., September 1, 1892.

To Collectors of Customs, Medical Officers of the Marine-Hospital Service, Foreign Steamship Companies, State and Local Boards of Health:

It having been officially declared that cholera is prevailing in various portions of Russia, Germany, and France, and at certain ports in Great Britain, as well as in Asia, and it having been made to appear that immigrants in large numbers are coming into the United States from the infected districts aforesaid, and that they and their personal effects are liable to introduce cholera into the United States, and that vessels conveying them are thereby a direct menace to the public health, and it having been further shown, that under the laws of the several states quarantine detentions may be imposed upon these vessels a sufficient length of time to insure against the introduction of contagious diseases, it is hereby ordered that no vessel from any foreign port carrying immigrants shall be permitted to enter at any port of the United States until said vessel shall have undergone a quarantine detention of twenty days (unless such detention is forbidden by the laws of the state or the regulations made thereunder) and of such greater number of days as may be fixed in each special case by the state authorities.

This circular to take immediate effect except in cases of vessels afloat at this date, which will be made the subject of special consideration upon due application to the Department.

WALTER WYMAN,
Supervising Surgeon-General U. S. Marine-Hospital Service.

CHARLES FOSTER,
Secretary of the Treasury.

Approved September 1, 1892.
BENJAMIN HARRISON.

The effect of this circular has been practically to suspend immigration. Under various claims for modification in the enforcement of its provisions, and to avoid extreme harshness, from time to time small numbers of immigrants have been admitted by the treasury department, but only after thorough disinfection of the baggage of these limited numbers. The first wilful attempt to over-ride the circular has been made by the steamer Weimar, which arrived at the U. S. quarantine station at Cape Charles, November 10th, with 1,900 odd immigrants on board. At the present writing this vessel has already been detained thirteen days in quarantine, at large daily expense to the steamship company, and it is expected that she will be detained the full twenty days. It is proposed to maintain this suspension of immigration for an indefinite period, or until congress shall have had an opportunity to express its will in the matter.

The question of who are immigrants within the meaning of the circular of September 1st, has been one of some dispute, and though verbal interpretation was given by the acting secretary of the treasury, who has charge of immigration matters, the following circular, November 16th, contains the only certified interpretation that has been given:

ENTRY OF VESSELS CARRYING IMMIGRANTS.

1892. Department No. 191. Division of Customs.

Treasury Department, Office of the Secretary,
Washington, D. C., November 16, 1892.

To Collectors and other Officers of the Customs:

The Department has received authentic assurance that the danger of cholera infection still exists, and that the measures of precaution which have been heretofore observed cannot be materially relaxed without imperilling the public safety. In order that the provisions of its circular, No. 150, of September 1, 1892, shall be uniformly applied, officers having supervision over the arrival of vessels are instructed as follows:

1. The Department adheres to its construction of the term "immigrants" as used in circular No. 150, and holds that any person who arrives from his home in a foreign country with the intention of making a permanent settlement here, is an immigrant within the terms of said circular.

2. Experience has demonstrated that the principal danger of infection through immigration arises from passengers brought over in the steerage. The crowding of the immigrants to the extreme limits of the steerage accommodations of many of the ships, the considerable quantity and character of their baggage and personal effects, and the consequent difficulty of maintaining those conditions of cleanliness and ventilation which are demanded by sanitary laws, are among the causes which create special danger of infection from the class of immigrants referred to. These perils do not arise from the transportation of passengers in the cabin, and the Department finds no occasion to interfere with the landing of the latter after they have passed the inspection of local health authorities.

3. The objections to the unrestricted admission of steerage immigrants do not apply to vessels in which the steerage is occupied by the limited number of citizens and residents of the United States and their families who are likely to avail themselves of the cheaper fares afforded by steerage tickets in returning to this country.

4. No vessel bringing foreign immigrants in the steerage will be relieved from the restrictions contained in circular No. 150. Vessels bringing no such steerage passengers, but having immigrants on board as cabin passengers, will not be refused entry after

having passed the local quarantine, but will be subject to the regulations contained in the following instructions, addressed to the Commissioner of Immigration on September 24 last:

"It is represented that you have informed steamship companies that you will require personal examination of all cabin passengers by a surgeon, boarding officer, and registry clerk. This is not deemed necessary, and it is probable that you are misunderstood. A cursory examination of the cabin passengers, as they pass experienced officers on leaving the ship, will be sufficient. You will only detain for examination such foreigners as you have reason to believe, from such examination or from the passenger list, are removing to this country for a permanent residence. A record examination of all cabin passengers is not contemplated by any instructions of the Department."

The inspection thus provided for is enforced because the Department has information which shows that persons of the prohibited classes, notably contract laborers, have been found to arrive in the cabin, in attempted evasion of the law. All immigrants coming as cabin passengers will be compelled to undergo the required examination, which is also desirable in order to insure the collection of the head tax on passengers not citizens of the United States.

This examination does not necessarily entail any detention of the vessel, as it will be made during the landing of the passengers, but all immigrants will be subjected to such further restraint and disinfection as the Commissioner of Immigration may consider requisite, and any baggage which shall appear to have been insufficiently disinfected, shall, before delivery, be disinfected at the expense of the consignees of the vessel.

This circular, so far as it modifies any instructions previously issued, will be applied to all vessels sailing from foreign ports after this date.

O. L. SPAULDING,
Acting Secretary.

The effect of the above is to prohibit immigration in the steerage.

As before said, the result of twenty days' detention imposed on vessels carrying immigrants has been practically its suspension, concerning which the New York *Sun* of recent date makes the following statement:

The stoppage of immigration for a period of more than ten weeks, under order of the president, is an incident without precedent in our history. It took place at a time when the volume of immigration was extraordinarily large. The number of immigrants who arrived at our ports during the eight months of this year ending with August last, was 12,000 greater than the number who arrived during the whole of last year, or 422,619 against 430,884. It is very certain that but for the restriction imposed by the president's order, fully 700,000 foreigners would have been added to our population within the current year. When the bars were put up the steerages of the whole fleet of immigrant-carrying ships were crowded to their utmost; and we had abundant evidence from Europe that this state of things would continue for an indefinite period of time.

CANADIAN BORDER INSPECTION SERVICE.

As a result of this embargo upon immigration at the maritime ports of the United States, it was feared that there would be a deviation of the European traffic to the ports of Canada, whence immigrants might reach the United States through the Canadian frontier. It therefore became necessary to establish a line of inspection along the whole of the Canadian frontier, from Maine to Dakota. Forty medical inspectors have been employed by the Marine-Hospital Service for this purpose, having the aid, by direction of the secretary of the treasury, of the collector of customs, the customs officers, and usual immigrant inspectors on

the border. The first circular to this end was issued August 30, 1892, directed to collectors of customs and others on the Canadian and Mexican frontiers, and directing them to coöperate with officers of the Marine-Hospital Service and local health officers in preventing the introduction of cholera into the United States.

VIGILANCE AGAINST CHOLERA.

1892. DEPARTMENT No. 148. DIVISION OF CUSTOMS.

TREASURY DEPARTMENT, OFFICE OF THE SECRETARY,
WASHINGTON, D. C., August 30, 1892.

To Collectors of Customs and Others:

Collectors of customs on the Canadian and Mexican frontiers are instructed to exercise special vigilance in the examination of immigrants and their effects, and to coöperate with the officers of the Marine-Hospital Service and local health officers in such action as they may deem advisable to prevent the introduction of cholera into the United States.

O. L. SPAULDING,
Acting Secretary.

It was about this date, namely, August 30th, that the line of medical inspectors was established, and September 3, 1892, instructions to these inspectors were issued, requiring the boarding of incoming trains, inspection of immigrants and baggage, and prevention of entry of either without prior disinfection of baggage; and rendering aid to state and local authorities.

INSTRUCTIONS TO CUSTOMS AND MEDICAL OFFICERS ACTING UNDER PROVISIONS OF DEPARTMENT CIRCULAR NO. 148.

1892. DEPARTMENT No. 153.

TREASURY DEPARTMENT,
OFFICE OF THE SUPERVISING SURGEON-GENERAL U. S. MARINE-HOSPITAL SERVICE,
WASHINGTON, D. C., September 3, 1892.

You are hereby directed to inspect all immigrants coming to the United States, and all other persons coming from any districts where cholera is prevailing, and enforce the provisions of Department circulars of July 8 (No. 112), August 17 (No. 141), and August 24 (No. 147), which are hereby made applicable to all vehicles crossing the frontier:

1. All incoming trains or boats to be boarded at some point without the United States, or at the border, or before entering a port if practicable.

2. Immigrants from the cholera-infected districts of Europe, Asia, or elsewhere to be separated from the ordinary passengers and held for inspection.

3. Baggage and effects of said immigrants to be separated and held, at some point to be selected, until the inspector is satisfied that they have been subjected to the disinfection required by said circulars.

In addition to the above, you will render assistance to state and local authorities in the enforcement of their health regulations.

WALTER WYMAN,
Supervising Surgeon-General U. S. M.-H. S.

Approved:
CHARLES FOSTER,
Secretary.

As a result of this measure, large numbers of immigrants without a certificate of disinfection of baggage, have been returned to various points in Canada, or have been detained at the frontier until their baggage has been disinfected in a proper manner under the supervision of a marine-hospital inspector. The disinfecting apparatus required has been demanded of either the Canadian authorities, or of the railroad authorities seeking to transfer their immigrants into the United States. In some instances box-cars have been fitted up at the frontier as steam-disinfecting chambers, the steam being supplied from the locomotive.

Additional quarantine measures taken by the bureau may be stated briefly.

1. To prevent entrance of infected vessels at smaller ports of the United States, where quarantine restraints are insufficient, collectors of customs at these ports being required to report regarding such assistants as might be required, with recommendation for appointment of a medical inspector if necessary. This provision, contained in the attached circular of September 19th, is aimed particularly at "tramp" steamers, and any others seeking to avoid greater restrictions at larger ports.

TO PREVENT THE ENTRANCE OF INFECTED VESSELS, OR VESSELS FROM INFECTED PORTS, ENTERING SMALLER PORTS OF THE UNITED STATES, WHERE QUARANTINE RESTRAINTS ARE INSUFFICIENT.

1892. DEPARTMENT No. 165.

TREASURY DEPARTMENT,
OFFICE SUPERVISING SURGEON-GENERAL M.-H. S.,
WASHINGTON, D. C., September 19, 1892.

To Collectors of Customs, Medical Officers of the Marine-Hospital Service, and State and Local Health Officers, and others whom it may concern:

It having been shown, that by reason of stringent quarantine restraints at the larger ports upon the seaboard, infected vessels, or vessels from infected ports, either belonging to regular lines or known as "tramps," may seek entry at smaller ports, where quarantine restraints are insufficient, it is hereby ordered that collectors of customs at smaller ports on the seaboard and at ports where local law or financial provision is insufficient, shall maintain unusual watchfulness with regard to said vessels, and impose the necessary quarantine restraints upon the same, reporting in each instance to the Marine-Hospital Bureau.

Collectors at the above-mentioned ports, after consultation with the local health authorities, will report to the Supervising Surgeon-General of the Marine-Hospital Service regarding such assistance as may be required to insure thorough inspection and disinfection of said vessels prior to entry, with recommendation of appointment, if need be, of a properly qualified medical inspector.

WALTER WYMAN,
Supervising Surgeon-General M.-H. S.

Approved:
CHARLES FOSTER,
Secretary.

2. It was learned that immigrants' baggage was shipped into the United States as cargo, to prevent the necessity of previous disinfection.

The danger from this source was obvious, and immediately upon receiving the information a letter was addressed to the secretary of the treasury, calling attention to the necessity of disinfection of all such articles of personal wear; and a circular has been issued, requiring that in the ware-houses in which these bundles of clothing are examined by the customs officials, fumigating-rooms shall be provided, and all such clothing be disinfected at the expense of the owners or shippers.

To insure the proper carrying out of the provisions of certain of the circulars above referred to, in foreign countries, and for the purpose of gaining reliable information which will be of service to the bureau, and to all state and local authorities, concerning the recent epidemic of cholera abroad and the dangers to which this country may be subjected thereby in the coming spring and summer, two medical officers have been detailed to make a thorough inspection of the chief ports of departure of immigrants, their duties including also other details, which at the present time it is expedient to enumerate.

The above is a statement of the general measures taken by the bureau, to which should be added also the regular weekly issue of the bulletin of sanitary information.

The more special efforts were in the manner of quarantine, viz.: the establishment of Camp Low for the relief of the over-burdened New York quarantine, the enlargement of the quarantine functions at the Breakwater quarantine at the mouth of the Delaware bay, and the erection there of permanent barracks for the accommodation of nearly 1,000 immigrants, the establishment of a complete marine quarantine, consisting of five vessels, at the mouth of the Chesapeake bay (Cape Charles quarantine), and the establishment of a quarantine at Camp Fort Pulaski, at the mouth of the Savannah river, for the protection of Savannah and the surrounding territory.

A sanitary expert, by request of the health officer of the port of New York, was detailed for duty at New York for the supervision of the scientific disinfection of the infected vessels in the harbor. Some items of valuable information acquired in the process of this work, showing how cholera may be spread upon infected vessels, will be given to the Association by Passed Assistant Surgeon J. J. Kinyonn.

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QUARANTINE AND THE UNITED STATES MARINE HOSPITAL SERVICE.

By A. N. BELL, A. M., M. D.,

Brooklyn, N. Y.

That every organized government has the right of protecting itself against the introduction of infectious and contagious diseases, and of putting any country, place, or thing in quarantine which would introduce such disease is unquestionable; but the measure of quarantine has, unfortunately, been so diverse by different authorities from the earliest period of its imposition to the present time and so inconsistent with even contemporary knowledge of preventable diseases, that, taken in the aggregate, it may well be questioned whether its administration, even at the present time, is not more promotive than preventive of the diseases it would avert. Quarantine regulations of one kind or another are well known to have existed contemporaneously with a knowledge of communicable diseases. To this country they are hereditary. In the seaports of the American colonies they were imposed independently of one another. From the outset of the general government the rightful authority for their administration speedily became, and has ever since continued to be, a subject of discussion, resulting in such heterogeneous legislation from time to time, that even the most competent legal authorities appear to be unable to decide whether it is state or national—it is mixed.

In the light of present knowledge of preventive methods against the introduction and spread of infectious and contagious diseases, and the recent indirectness of dealing with cholera at the port of New York, surely the time is now propitious for this Association to urge upon congress such definite action in this regard as would be alike more reliable against the introduction of preventable disease and less obstructive to commerce than has been the recent action of the mixed authorities at the port of New York.

In a paper on "The Need of National Legislation for the Protection of Human Life," read to another body,[1] a few months ago, I took occasion to say,—

[1] Read in the Section on State Medicine, American Medical Association, at Detroit, Mich., June 8, 1892.

This need obtains to a larger degree for the United States than for any other country in the world, because while the States severally have many inherent rights and obligations of their own, and among those rights certainly that of self-protection against dangers to human life, the nation alone has power to regulate commerce; and because, related to this commerce, the United States greatly exceeds any other country in the world as the collective centre of all nationalities and habits of life, more or less at variance with the conditions promotive of or in conflict with their own health or of the public health in this country.

Commerce, as hitherto conducted in the United States, in default of national legislation to prohibit the introduction of epidemic diseases has been and is in constant antagonism to the efforts of the states and their seaports to prevent their introduction. Hence, it may be truthfully asserted with regard to sanitary progress in this country, that it has not only been made for the most part without the aid of the general government, but in actual contention against the government practice in the contrary direction.

But my present purpose is to deal wholly with quarantine, and particularly with regard to its state, national, and international bearings —a subject, as will presently appear, which I have long thought of.

At the third meeting of the National Quarantine and Sanitary Association, at New York, in 1859, I was made chairman of a committee on the following resolutions:

Resolved, That the operations of quarantine should not be confined to the warm months of the year; inasmuch as a vessel, arriving in midwinter, with small-pox or typhus on board, is as legitimate a subject for quarantine as one arriving in midsummer.

Resolved, That the adoption, by the commercial nations, of a sound and well-digested code of marine hygiene, and of the necessary measures for insuring its strict enforcement, would tend greatly to alleviate the evils of the present system of quarantine, and promote the comfort of passengers and crew.

Resolved, That this convention appoint a committee to consider and report in what manner the foregoing resolutions may be most effectually carried out.

Resolved, That the committee report, at the next meeting of this convention [in Boston, June 14, 1860], specific recommendations of principles and measures of quarantine, as severally applicable to yellow-fever, cholera, typhus-fever, and small-pox, having reference also to the variations which different localities require.

My associates were,—Drs. Elisha Harris, Wilson Jewell, Isaac A. Nichols, and D. B. Reid, all since deceased, and so, too, a contributory Committee on Quarantine Docks and Warehouses—Drs. John W. Sterling, Alexander H. Stephens, and John McNulty.

The committee reported at the time and place designated in the fourth resolution, and as the work undertaken was not considered complete, the committee was continued with the same chairman and additional members; but on account of the rebellion which followed the next year, the meeting at Boston turned out to be the last ever held by that Association. The American Public Health Association is its offspring. Hence, it seems to me eminently proper, as I am the only member of that committee left, at a time when the sanitary sense is more susceptible to its action, and the legislative authorities, it is hoped, more appreciative of the importance of the subject, that I should submit to this Association the benefit—if there be any—of my subsequent reflections upon the work of that committee; and the more, since the progress of practical sanitation

meanwhile has done much more to confirm than to modify the conclusions reached by it.

Indeed, so much more pertinent are the recommendations of that report to the present exigencies of state, national, and international measures for the prevention and spread of epidemic diseases, than they were at the time they were first uttered, taken in conjunction with some success in their practical application, that I feel fully justified in urging them—modified to some extent, however—after thirty-two years additional observation and effort, as appropriate to the present time.

The removal of all persons, the complete segregation of persons sick with different infectious or contagious diseases and of both from well persons, *immediately* upon the arrival at port of an infected vessel; the prompt and thorough disinfection of merchandise and vessels, and their speedy clearance; the proper location of quarantine hospitals, places of detention for well persons during the incubative period and anchorage of infected vessels for the time being, with special reference to mutual safety and without danger to the public—were measures urged no less vehemently at that time than they are now. And with regard to hospitals:

Whether erected on the shores, or floating, the number of separate hospitals should be sufficient to give at least one for each of the diseases that are to be provided for at any one period; and the hospitals should be so arranged as to secure—

1. Perfect cleanliness.
2. Ample space for patients.
3. Complete and controllable ventilation.
4. The best facilities for the reception and care of the sick.
5. The requisite means for cleansing and disinfecting bedding and clothing.

There can be no better test of the good management of hospitals for pestilent diseases than that the hospital wards be so free from contamination that they do not become infected places. To preserve a typhus-fever or a small-pox ward from infectious contamination, and consequently to secure the welfare of its inmates, it is indispensably necessary that the air-space be much greater than has usually been provided in our hospitals. In the wards for cholera and for yellow-fever, the welfare of the sick, if not the safety of attendants, requires a liberal and constant supply of fresh air.

To attain such a degree of sanitary security in quarantine or fever hospitals, it is necessary that ample space be allotted to the sick. Not less than two thousand five hundred cubic feet of air-space should be allotted to each patient, unless the facilities for insuring the constant supply of fresh air from without, by means of arrangements for plenum ventilation, be of an unusual character.

There cannot be a more highly important regulation in any hospital than that which secures the immediate cleansing of every utensil and every article of personal and hospital clothing as soon as soiled; and

in the arrangement of a quarantine establishment, none is more essential than that which provides for the immediate and thorough *disinfection* of all articles of clothing, bedding, etc., both from infected vessels and hospital wards. It is not only desirable, but necessary, that every quarantine establishment should be provided with ample means for effecting such purification and disinfection, as a grand measure of sanitary protection against all personal and common *fomites* of pestilent diseases.

Notwithstanding the general impression regarding the uncertainty of the ordinary chemical disinfectants, so called, it will not be denied that all articles of clothing may be, and certainly ought to be, completely disinfected and thoroughly cleansed by some speedy and effectual process, at every quarantine establishment.

In the present state of our knowledge respecting the essential nature of these infections, and their relations to physiological and atmospheric chemistry, it is not to be expected that positive chemical disinfectants will be successfully applied; but we recommend, however, that, for the disinfection of all *fomites* and apartments contaminated with yellow-fever or any other febrile poison, full experiment be made with steam or with dry heat above 200° F., as an effectual mode of disinfection and purification, whenever and to whatever such heat may be safely applied. This recommendation is based upon obvious principles and varied observations that need not be stated here. But suggestions respecting extreme temperatures, forced ventilation, etc., are made solely with reference to the practical applications of reliable means for such processes of disinfection as may readily and effectually be put in requisition in hospitals, contaminated apartments, quarantine warehouses, and infected vessels. And for this purpose the committee recommend,—

That in connection with every quarantine establishment, at the warehouses as well as at the hospitals, properly constructed steam-generators and steam chambers or vats, be provided for the disinfection of all personal, hospital, and ship's clothing and bedding, together with such other infected goods or things as may properly be subjected to high steam heat.

It is also recommended that at every quarantine establishment it shall be an established rule that all articles of clothing, bedding, or dunnage on board of vessels suspected of being contaminated with yellow-fever or cholera, and liable to propagate the same, shall be subjected to high steam or dry heat for the purpose of disinfection; and that this duty be attended to as soon as convenient after the arrival of the infected vessel or things; and especially, that without such process having been performed no article or thing whatsoever shall be thrown overboard or otherwise disposed of, except by rapid incineration or by being securely sunken under the water.

It is also recommended that in every quarantine hospital it be an established *rule*, that all articles of personal clothing, bedding, and every kind of absorbent material pertaining to the furniture and utensils of the wards, or the care of the sick or the dead, be removed to the steam-vats as soon as they become soiled or contaminated; and it is further recommended that, in addition to means for ventilation, provision be made for the application of heat, by steam or otherwise, in the wards where pestilential infection is liable to be perpetuated.

In the case of *fomites* of small-pox and of typhus-fever, the same rule is recommended to all sanitary authorities, connected either with the internal or the external police of cities.

The foregoing suggestions and recommendations embrace the most important measures, which are of essential importance in the executive management of quarantine hospitals; and all specific regulations that the committee would recommend on this subject may be concisely summed up under the heads of,—

1. *Ample air-space and effectual ventilation.*
2. Proper supply and control of sunlight in the wards.
3. Such construction and such material for hospital wards as not to favor the retention and perpetuation of febrile poisons and pestilent emanations.
4. Means for *immediate* and safe disinfection of all clothing, bedding, etc.
5. Facilities for the reception of the sick, and for the removal and burial of the dead without the observation of the patients in the wards.
6. A resident medical officer, who shall have control of the internal management and police of the hospitals.

It seems almost unnecessary to add that the most important progress made by sanitarians in the means of disinfection during the interval since the report from which the foregoing is an abstract, has been the thorough verification of the utility of steam, as at that time urged; and the utility of chemical disinfectants, as reported by the Committee on Disinfection and Disinfectants of this Association in 1888.

But for the purpose of this paper particular attention is invited to the second one of the resolutions quoted.

That the adoption, by the commercial nations, of a sound and well-digested code of marine hygiene, and of the necessary measures for insuring its strict enforcement, would tend greatly to alleviate the evils of the present system of quarantine and promote the comfort of passengers and crew.

In virtue of this the following postulates are respectfully submitted, as a basis for national and international quarantine:

I. DECLARATIONS.

1. Every organized government has the right of protecting itself against the introduction of infectious diseases, and of putting any country, place, or thing in quarantine which would introduce infectious diseases; provided, however, that no sanitary measure shall go so far as to exclude or drive from port a vessel, whatever may be her condition.

2. All quarantine regulations, of any place whatever, should bear with equal force against the toleration or propagation of disease as against its introduction; and authority to prevent the introduction of disease in any place should be equally applicable against its exportation.

3. The application of quarantine regulations shall be regulated by the official declaration of the constituted sanitary authority at the port of departure where the malady exists. The cessation of these measures shall be determined by a like declaration that the malady has ceased—after, however, the expiration of a fixed delay of thirty days for the plague, fifteen days for yellow-fever, and ten days for cholera.

4. It is obligatory on all vessels to have a BILL OF HEALTH; this shall consist of two kinds only, a *clean bill* and a *gross bill*, the first for the attested absence of disease, and the second for the attested presence of disease. The bill shall state the hygienic state of the vessel; and a vessel

in a bad condition, even with a clean bill of health, shall be regarded as a vessel having a gross bill, and shall be submitted to the same *regime*.

5. The power of applying the general principles of this code, and of acceding to its provisions, is expressly reserved to those nations and governments who consent to accept the obligations it imposes; and all the administrative measures proceeding from it shall be determined by international sanitary regulations, or by a convention of the representatives of the governments which have adopted it.

II. MEASURES RELATING TO DEPARTURE.

6. Measures relating to departure comprise observation, inspection, and the ascertaining of the sanitary state of the place and vicinity; the examination and ascertaining of the hygienic state of the vessel which is about leaving, of its cargo and provisions, of the health of the crew, and, if there are any passengers, of their health also; and lastly, of the bill of health, and all relating thereto. These observations, inspections, and examinations shall be confined to the authorities hereinafter designated.

7. All vessels before lading must be visited by a delegate of the sanitary authority, who shall be a doctor of medicine, and submit to hygienic measures, if deemed necessary. The vessel shall be visited in all her parts, and her hygienic state ascertained. The authority shall inquire into the state of the provisions and beverages, in particular of the potable water and the means of preserving it; he shall also inquire into the state of the crew, and in general into everything relating to the maintenance of health on board. If any person has been shipped, having a transmissable disease, such person shall be forthwith discarded.

8. Captains and masters shall furnish to the sanitary authority all the information and all the evidence, to the best of their knowledge, demanded of them. If the sanitary authority judges necessary, and does not believe himself sufficiently informed by the captain or other persons in charge, he can proceed to a new visit, after the lading of the ship, in order to assure himself if all the prescribed hygienic measures have been observed.

9. These various visits shall be made without delay, and in such a manner as to avoid unnecessary loss to the ship.

10. Vessels carrying a foreign flag shall be visited by the sanitary authority, with the consul or consular agent of the nation to which the vessel belongs.

11. The number of passengers embarking on sailing vessels or steamers, the arrangement of their accommodations, and the quantity of provisions on board for the probable length of voyage shall be determined by the particular regulations of different governments adopting this code. But in no case should the number of individuals to be accommodated on board any vessel, or in any apartment provided for the accommodation of crew or passengers, exceed in ratio one individual to every one hundred and fifty cubic feet of air space, together with provision for effectual ventilation in all weathers.

12. Passenger vessels of whatever size, and all vessels carrying sixty persons, or a smaller number, including crew, shall furnish themselves with the necessary medicines and apparatus for the treatment of the most ordinary diseases and accidents likely to happen on board. And it shall be the duty of the sanitary administration of each government to make out a catalogue of the medicines and apparatus, and detailed instructions for their use on board all vessels of this class.

13. All sea-going passenger vessels and all vessels having a larger number of persons on board than named in the last preceding article, shall carry a doctor of medicine, approved of by the sanitary authority. Bills of health shall not hereafter be delivered until after the fulfilment of the regulations herein specified.

14. Vessels of the navy and revenue vessels shall not be subject to the preceding regulations.

15. In ordinary times, fishing-vessels, pilot-boats, vessels in the coasting trade, of the same country, and canal-boats, need not carry a bill of health; the sanitary regulations of this class of vessels shall be determined by the local authorities.

16. No vessel shall have more than one bill of health.

17. Bills of health shall be delivered in the name of the local government by the sanitary authority, *viséd* by the consuls or commercial agents, and be of credit in the ports of all governments adopting this code.

18. The bill of health shall contain the name of the vessel, the name of the captain, or master, and the results of the examination, relating to the tonnage, merchandise, crew, and passengers; it shall state the exact sanitary condition of the place, the hygienic state of the ship, and whether there are any sick on board. In short, the bill shall contain all the information that can enlighten the sanitary authority of the port of destination, to give him as exact an idea as possible of the public health at the place of departure and environs; of the state of the ship, her cargo, the health of the crew and passengers; the environs of those places in habitual communication with the port of departure, and possessing the same sanitary relations.

19. Whenever there prevails at the place of departure, or in its environs, any epidemic disease reputed to be importable or transmissible, and when the sanitary authority shall have declared its existence, the bill shall give the date of the declaration. It shall give the date of the cessation of the same when the cessation shall have been established.

20. In conformity to the provisions of Article 6, the bill of health must be either *clean* or *gross*. The sanitary authority shall always pronounce upon the existence or non-existence of disease at the port of departure. Doubtful cases shall be interpreted in the most prudent sense—and the bill shall be gross. In regard to passengers: For those whose health may be suspected, the sanitary authority may demand the certificate of a doctor of medicine, known to him to be of good standing, and if any proposed passenger is thus found to be in a condition compromising the

healthfulness of the ship or the health of persons on board, he shall, upon the direction of the sanitary authority, be prohibited.

21. Bills of health can only be considered as valid when they have been delivered within the forty-eight hours last preceding departure. If the departure is delayed beyond this period, the bill must be *viséd* by the authority delivering it, stating whatever change may have taken place.

22. The existence of transmissible or importable disease in the quarantine establishment of any place shall not alone be considered cause sufficient for a *gross* bill of health.

III. SANITARY MEASURES DURING THE VOYAGE.

23. All vessels at sea shall be kept in a good state of ventilation and cleanliness. And to this end it shall be the duty of the sanitary authority at the port of departure, to see that every vessel is provided with the necessary means, and that captains and masters are sufficiently conversant with the use of those means, for the purposes indicated.

24. Captains and masters shall conform to the instructions of the sanitary authority; otherwise, on arriving, they shall be considered as having a *gross* bill of health, and be treated accordingly.

25. Physicians attached to sea-going vessels shall be considered as the agents of the sanitary authority, and it shall be their special mission to watch the health of the crew and passengers, to see that the rules of hygiene are observed, and, on the arrival of the vessel, to give an account of the circumstances of the voyage. They must also keep an exact record of all circumstances of interest to the public health, meteorological observations, etc., and note with particular care the history and treatment of all the diseases and accidents that occur.

26. In vessels carrying no physician, it shall be the duty of the master or captain to fulfil, as far as practicable, the obligations of the last preceding article.

27. All captains or masters touching at or communicating with a port, shall have their bills of health *viséd* by the sanitary authority; or in default of such authority, by the delegated officer of the local police.

28. It is forbidden to the sanitary authority at the port where a vessel touches, or holds communication, to retain the bill of health given at the port of departure.

29. In cases of death at sea from a disease of a suspected character, the wearing apparel and bedding which have been used by the deceased in the course of his sickness, shall be burned if the ship is at anchor; if *en route*, thrown into the sea, with the necessary precaution that they shall not float. Other articles belonging to the deceased shall be immediately purified by aeration or otherwise.

IV. SANITARY MEASURES ON ARRIVAL.

30. All vessels on arrival shall submit to an examination and questioning as soon as practicable. The examination and questioning shall be

made by the sanitary authority delegated for that purpose; and the result shall be recorded upon a special register.

31. All vessels, furnished with a clean bill of health, which have had during the voyage no disease or communication of a suspected nature, and which present a satisfactory hygienic condition, shall be admitted to *pratique* immediately after examination.

32. All well persons shall be removed from an infected vessel, as soon as possible after arrival, to the place of detention, and there kept not longer than five days after the expiration of the accepted period of incubation of the disease to which they have been exposed, excepting small-pox; those who have been exposed to it and have evidence of effectual vaccination, shall be allowed their freedom immediately; those who have not such evidence shall be vaccinated forthwith and detained until the vaccinia shall have taken effect, or in the event of its failure, given their liberty at the end of seven days.

33. Whenever there are sick on board, they shall be removed as promptly as possible from the vessel to clean and airy rooms on shore, or to a floating hospital moored in a healthful situation. The detention of such persons in an infected ship is obviously most objectionable, and should be allowed under no circumstances whatever.

34. The experience of quarantine shows that the fears of pestilential disease being introduced by the ordinary cargoes of dry and imperishable goods is groundless, and that, with the temporary exceptions hereinafter provided, such cargoes shall be admitted to *pratique* immediately after examination. Nevertheless, there are numerous articles of commerce which should not be landed except under special restrictions, and apart from all populous neighborhoods.

35. The application of sanitary measures to merchandise shall be arranged in three classes: (1) Merchandise to be submitted to an obligatory quarantine and to purification; (2) merchandise subject to an optional quarantine, and (3) merchandise exempt from quarantine.

The first class comprises clothing, bedding, personal baggage, rags, paper, paper-rags, hides, skins, feathers, hair, and all other remains of animals, woollens, and silks.

The second class comprehends cotton, linen, and hemp; and *cattle.*

The third class comprehends all merchandise not enumerated in the other two classes.

36. With a *gross bill* and existing quarantinable disease on board, or if there has been such disease on board within the ten days last preceding, merchandise of the *first* class shall always be subject to inspection, and to disinfection if deemed necessary. Merchandise of the *second* class may be admitted to *pratique* immediately, or treated according to circumstances, at the option of the sanitary authority, with due regard to the sanitary regulations of the port. Merchandise of the *third* class shall be declared free and admitted without unnecessary delay.

37. A foul ship is much more to be dreaded, as a vehicle of introducing disease, than anything she has on board; and vessels in a filthy,

unwholesome state, whether there has been sickness on board or not, should not be allowed to enter a crowded port, or to lie alongside a wharf or other ships, until they have been broken out, duly cleansed, and ventilated.

38. If a vessel, though furnished with a *clean* bill of health, and having had during the voyage no case of sickness, yet be found in a bad or infected state, or in a condition which the sanitary authority judges compromising to the public health, the vessel and cargo shall be detained until the case has been considered by the authority; his decision, however, shall be rendered within twenty-four hours.

39. If, in the judgment of the sanitary authority, the vessel requires it, he may order the following hygienic measures: Baths and other bodily care for the *personnel*, washing or disinfecting means for clothing; displacement of merchandise on board, or a complete breaking out; subjection to steam heat at not less than 175° F., for twenty minutes; incineration or submersion at a distance, in the sea, of infected articles; the destruction of tainted or spoiled food or beverages; the complete ejection of water; thorough cleansing of the hold, and the disinfection of the bilge; in short, the complete cleansing and ventilation of the vessel in all her parts, by the use of force-pumps, steam under pressure at not less than 175° F. for one hour, washing, rubbing, or scraping, and finally sending to an isolated anchorage ground. Whenever these divers operations are deemed necessary, they shall be executed in the more or less complete isolation of the vessel, according to circumstances, but always before admission to *pratique*.

40. All vessels having no bill of health, which, by reason of the place from whence they came, could not obtain one, or in case of accidental loss of bill, shall submit to restrictions according to circumstances, depending upon the judgment of the sanitary authority in conformity with the provisions herein established.

41. All bills showing evidence of erasure or alteration shall be considered null, and shall incur the conditions of the last preceding article, without prejudice to the proceedings which may be instituted against the authors of the alterations.

42. A doubtful case, reported in an unsatisfactory manner, shall always be interpreted in the most prudent sense: the vessel shall be provisionally detained.

43. Admission to *pratique* shall be preceded by as many visits to the vessel as the sanitary authority may judge necessary.

44. No vessel can be put in quarantine, without a stated decision of the sanitary authority, which shall be rendered within twenty-four hours from the time of arrival. The captain or master of the vessel shall be informed immediately after this decision.

45. Besides the specific measures in the foregoing regulations, the sanitary authority of each country or port has the right, according to Article 1, in the presence of immediate danger, to take the responsibility

of applying such additional measures as may be deemed indispensable for the protection of public health.

46. Notwithstanding the preceding regulations, whenever the sanitary state is positively healthy, vessels going from one port to another in the same country can, in virtue of the particular sanitary regulations of each country, be freed from sanitary examinations. And, in ordinary times, by virtue of declarations exchanged between the contracting nations, all vessels, proceeding or intending to proceed from one of two countries to the ports of the other, may also be free from examination.

V. EXECUTIVE ARRANGEMENT.

47. Every seaport town requiring the obligations of quarantine, should have a quarantine hospital for sick persons; a place of detention for well persons during the period of incubation; a disinfectant plant, and a designated anchorage ground for infected vessels; these several parts of the establishment shall be at such a distance and direction from each other, and all populous neighborhoods, infectious and infectable places, as to endanger the life of no one.

48. On the arrival of infected vessels at the quarantine establishment, all well persons shall be admitted to *pratique* as soon as possibly consistent with the foregoing regulations; sick persons shall be immediately transferred to the quarantine hospital, or to hospital ships, and the vessel unladen as soon as practicable. All infected merchandise not capable of immediate disinfection by ordinary means, shall be placed in capacious, perfectly secure, and well-ventilated warehouses or sheds, and there freely exposed to the air, and moved from time to time to insure its perfect disinfection.

49. Merchandise of the first class [Article 35] shall be submitted to such measures of purification as the sanitary authority shall judge necessary. No putrefied animal or vegetable substances, or substances likely to putrefy, shall be admitted into the warehouses. All such substances shall be rendered innoxious or destroyed.

50. All governments and places adopting this code shall as soon as practicable provide the necessary arrangements and appurtenances for fulfilling the obligations it imposes.

51. In case of the arrival of infected vessels at a port not provided with a quarantine establishment, vessels or hulks may be appropriated to the service of the sick, and also for the reception of merchandise; but in such cases they shall be disposed in such a manner as will permit the separation of the sick and assure the best conditions of hygiene, especially ventilation. But under no circumstances whatever shall sick persons be kept in proximity with infected goods. Well persons shall have their liberties as soon as practicable, consistent with the preceding regulations; and all other measures essential for the protection of public health shall be instituted according to the exigencies of the case, provided they are not inconsistent with the tenor and spirit of these regulations.

VI. SANITARY AUTHORITIES.

52. Sanitary authorities shall be established upon a uniform basis by the countries or governments adopting this code, and shall be composed,—First, of a responsible agent of the government, who shall be a doctor of medicine; and, second, of a local sanitary council or board of health.

On the acceptance of the report, from which the above is a revision, by the convention to which it was submitted, at the request of the committee the following resolution was adopted,—

Resolved, That this report be referred back to the committee with directions to negotiate with our national government or department of state, to secure, by convention or otherwise, the national and international adoption of a code based upon the principles hereinbefore set forth.

It was apparent to the chief authors of that report, the late Dr. Elisha Harris and myself, that the resolution which has just been read would at least be fruitless for many years. In the United States the report had no basis whatever to stand upon. "Sanitary authority," as related to practical effect, were words devoid of meaning. Such a thing as a national board of health had not been thought of,—not until fourteen years thereafter was our first state board organized; the only boards of health among us were common council or aldermanic committees of our large cities, with "health wardens" for inspectors, whose competency may be judged by the following extract from the address, by Hon. Andrew D. White, at the first annual meeting of this Association, in New York, 1873. He said,—

It is now about five years since, with two other members of our state senate, I visited this city, and sat here in the commission for examining into certain branches of the city administration, and especially into the conduct of that branch which had charge of the public health. The state of things revealed was such as could only exist under a great and widespread ignorance on the part of citizens of the first principles of sanitary science. To give an idea of this ignorance, let me recall, as nearly as I can, a little episode in the investigation. It happened that the late Judge Whiting, who had charge of the investigation on the part of the Citizen's Association, put on the stand a young physician, who testified that the health officers, or wardens, or inspectors, were men utterly ignorant of the first principles relating to the public health which they were appointed to preserve. In order to refute this, the head of the health department at the time brought on the stand, in perfect good faith, several of these health officers. Toward the close of the examination of the first gentlemen, Judge Whiting asked this question: "Did you have a case of small-pox in your ward?" and he answered, "Yes, sir." Judge Whiting: "Did you visit the patient?" Witness: "No, sir." Judge Whiting: "Why not?" Witness: "For the same reason that you would not—that I was afraid of taking it myself." Judge Whiting: "Did the family have any care?" Witness: "Yes, sir; they were highjinnicks [hygienics]: they doctored themselves." As other witnesses came in Judge Whiting used this as a sort of test question—as a sort of a key to unlock the system, and show the utter ignorance that prevailed in every department of it. Every witness was asked,—"Well, have you any highjinnicks in your ward?" Some of the witnesses thought they had, some thought they had not, some thought they "had them pretty badly," some thought they "had them in some parts of the ward," some thought they "had them in other parts of the ward." At last the judge asked a witness who had

been answering his question in this way: "Do you know what the word highjinnicks means?" and he replied, "Yes, sir; I do! It means a bad smell arising from dirty water."[1]

This illustration of the kind of sanitary authority and its agents, in New York, *seven years subsequent* to the time that the Committee of the National Quarantine and Sanitary Convention was directed to treat with such bodies, is not a farfetched example. Similar boards were common to our larger cities; in smaller ones and in country towns there was no sanitary pretence whatever. Among foreign countries England stood almost alone, and her general board of health at that time was only twelve years old. In short, the essential condition for carrying out the purpose of the resolution, the existence of sanitary authorities, was almost wholly wanting. Quarantines there were in abundance at seaports throughout the world—according to the significance of the term—which the general board of health promptly renounced, and instituted energetic sanitation instead; and—in so far as the word quarantine is still used to indicate the prompt notification and segregation of persons ill with communicable diseases, and the restriction until purification, or destruction, of infected material is now everywhere practised by enlightened communities, as first instituted by the general board of health of England—such quarantines have been multiplied a thousandfold. In the United States, as elsewhere, it is an essential element of preventive medicine, incorporated with every state and local board of health, inland no less generally than on the seaboard, and with like energy. Sanitary authorities have multiplied in like proportion, and their coöperation is essential to the protection of the public health; but the preëminent need in the United States is a concentrating force, a *national* sanitary authority, whose duty it should be to maintain a periscopic view, to anticipate danger, give warning, and promptly supply aid whenever and wherever it is required.

At the outset the United States essayed to aid the seaports by providing hospitals for those sick with infectious diseases, and warehouses for infected merchandise. The United States Marine Hospital Service was a contemporary provision, "for the relief of sick and disabled seamen."

To understand how greatly the scope of this service has magnified during recent years, if exercised for the prevention of disease among seamen, a glance should be taken at the enormous and still increasing commerce on the inland water-ways of the United States, as compared with the seaboard. In 1890 the arrivals and clearances of vessels at Chicago amounted to 21,541, while those of New York numbered only 15,283. The total entries and clearances of the entire seaboard of the United States, according to the statistical records, were 37,756 vessels, while the arrivals and clearances of vessels at the ports of the great lakes numbered 88,280.

"Seamen," under the purview of the Marine Hospital Service, comprehends "all persons employed on board in the care, preservation, or

[1]Public Health, vol. i., pages 141-142.

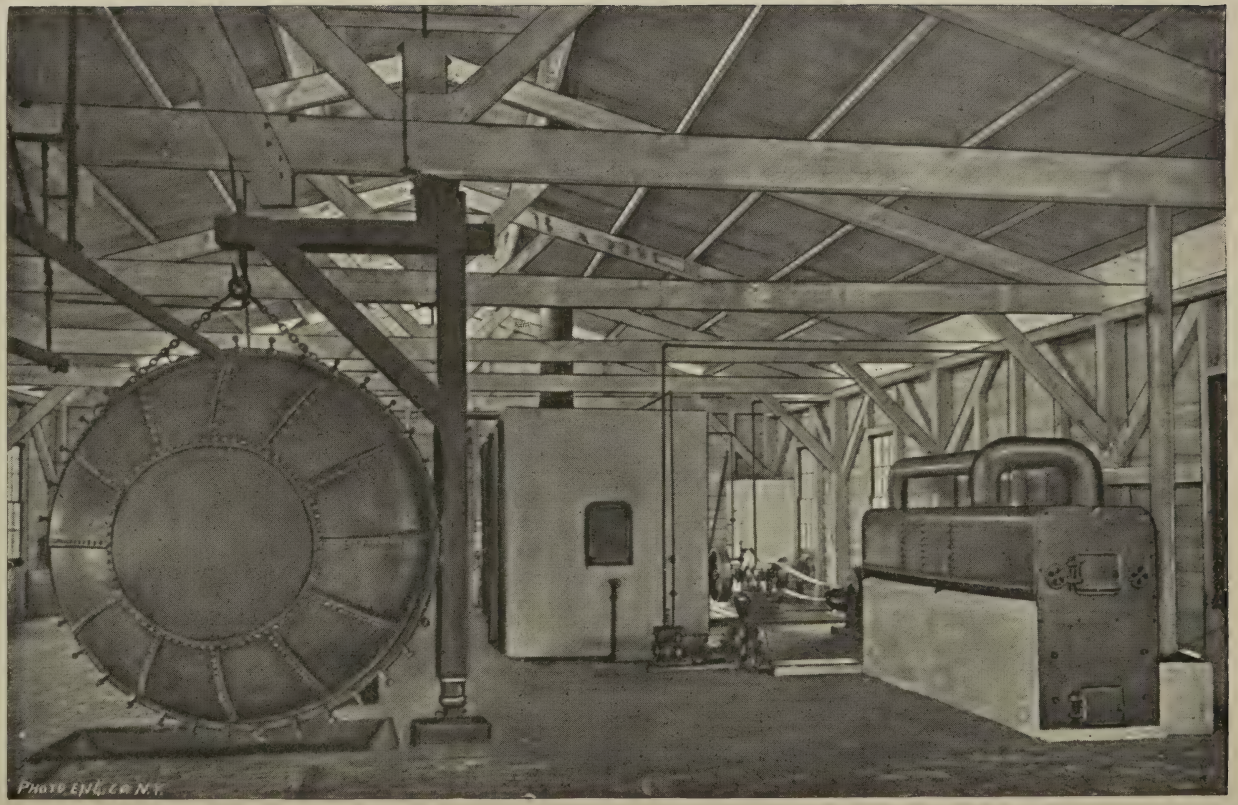
navigation of any vessel, or in the service, on board, of those engaged in such care, preservation, or navigation." Yet in default of any record to the contrary, this enormous aggregate of vessels of every class and the needful supplies for the well-being of the thousands of men, women, and children employed on board in the navigation, care, service, and keeping of them, was wholly without sanitary inspection! And so, too, every *clearance* of the smaller number—but yet thousands—of vessels from the seaboard,—*all* are allowed to *depart* without any sanitary supervision with regard to the necessary conditions for maintaining the health of the seamen and passengers or their liability to introduce disease at their ports of destination.

"Quarantine" measures relating to departure, under the light of such knowledge, should at least be coördinate with those exercised at ports of arrival; and all the more with regard to clearances at our seaports, if we would secure the coöperation of sanitary authorities abroad to prevent the transportation of infectious diseases hither.

The United States Marine Hospital Service, in default of a national organization, has done some excellent work for the prevention of the transportation of yellow-fever hither from Havana, but it has been wholly dependent upon the courtesy of the civil authorities at that port. For certainly it must be well known to all persons conversant with the exclusive rights and practice of foreign nations, that such sanitary service is essentially unstable, ever liable to conflict with the sanitary authorities at ports of departure, and cannot be relied upon to prohibit the departure of an infected ship. The Marine Hospital Service is out of its sphere in this direction, while there is an open field for its labors in another, if the United States would set the example by practising its own precepts—would see to it that the condition of *every vessel*, before she is permitted to receive cargo, is *clean* and equipped in a sanitary sense, and not at the mere voice of her master.

Surely it would be difficult to designate a more inviting field of labor—certainly none more germane to all that pertains to the health of "seamen" or passengers—than this for the Marine Hospital Service.

With such coöperation as this suggestion contemplates, under the auspices of a national board of health, and the international sanitary service which it would then be certain to secure, the transmission of epidemic diseases by commerce would be greatly diminished, if not, indeed, wholly prevented.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LI.

GERMICIDAL VALUE OF STEAM HEAT IN MARITIME SANITATION.

Department of Health,
Charleston, S. C., Nov. 3, 1892.

To the President and Members of the American Public Health Association:

Gentlemen: I beg to call to your attention the subjoined statement of some experiments made last June at the Charleston Quarantine Station, testing the germicidal power of the steam cylinder at that point. Your attention is called for a full and complete description of the plant in use to Vol. xvi A. P. H. A., page 121. Also to plates accompanying the paper, showing the steam cylinder, opened and closed.

These tests were most carefully made by Dr. Eugene Wasdin, Professor of Path. and Hist., Medical College State of South Carolina. It will be seen that on the full application of steam pressure heat at 230° all microbes were destroyed, spores and spore bearing, with the single exception of Bacillus Subtilis. This contribution is made to indicate to you that on the full application of heat at 230° complete lethal effect was produced. The tests between blankets were most carefully made, and the heat penetrated thoroughly through a number of folds, many more than would be found usually in clothing or hanging, subjected usually to these influences from vessels arriving here from suspected or infected ports. It seems to me eminently proper that as the Committee on Disinfection of the A. P. H. A., in their published recommendation, page 80, 81, through Dr. Sternberg, have called attention to the germicidal value of moist heat, that this test should be as it is constantly and practically used at the Charleston Quarantine Station, made known to you.

The same experience seems to have held as to the Bacillus Subtilis, which is a most resistant form of bacterial life, and so noted by Dr. Sternberg. I do not know that I can add anything new on this subject, but in closing this very brief paper, it occurs to me that it is a most important matter that the A. P. H. A. should impress on all municipalities, as we are discussing at this meeting "the most dangerous communicable diseases," that they should be provided for disinfecting purposes with a convenient form of apparatus for the application of moist heat in dwellings where these diseases happen to occur. While I feel confident that much good is constantly being effected with the means at our disposal, I can certainly feel, with the lights before us and such a test as we have demonstrated in Charleston, that every well equipped

city ready for the destruction of the germs of disease should have a plant that rapidly and certainly will afford moist heat at 230°, and that can readily be carried from point to point as required.

H. B. Horlbeck,
Health Officer of Charleston.

Laboratory of the Medical College
of the State of South Carolina.
June 8, 1892.

Hall T. McGee, Esq., *Chairman of the Committee on Maritime Sanitation, Board of Health of Charleston, S. C.:*

Dear Sir: In compliance with your request, I submit the results of my examination into the germicidal influence of the heat as used in the "disinfecting chamber" of the quarantine station under your especial supervision.

As you are aware, the microörganisms used in these tests were in pure culture, fifty-four hours old, upon beef-peptone-agar-agar and cotton-wool.

I must express my regret that it was impracticable for me to obtain at this time cultures of cholera Asiatica,[1] but those submitted to the tests are of sufficient tenacity of life to serve our purpose. You will observe that a number of bacilli obtained from Charleston sewer mud were used. I have found these organisms very resistant to heat, and their spores remarkably so. I have utilized other more or less resistant germs on hand in the laboratory.

The first test was simply that of dry heat in the chamber at 194° F.—the degree usually attained in the process of disinfection at the station, prior to the admission of live steam into the chamber—upon organisms placed at various points therein. This heat was held for fifteen minutes, and the tubes removed from the chamber.

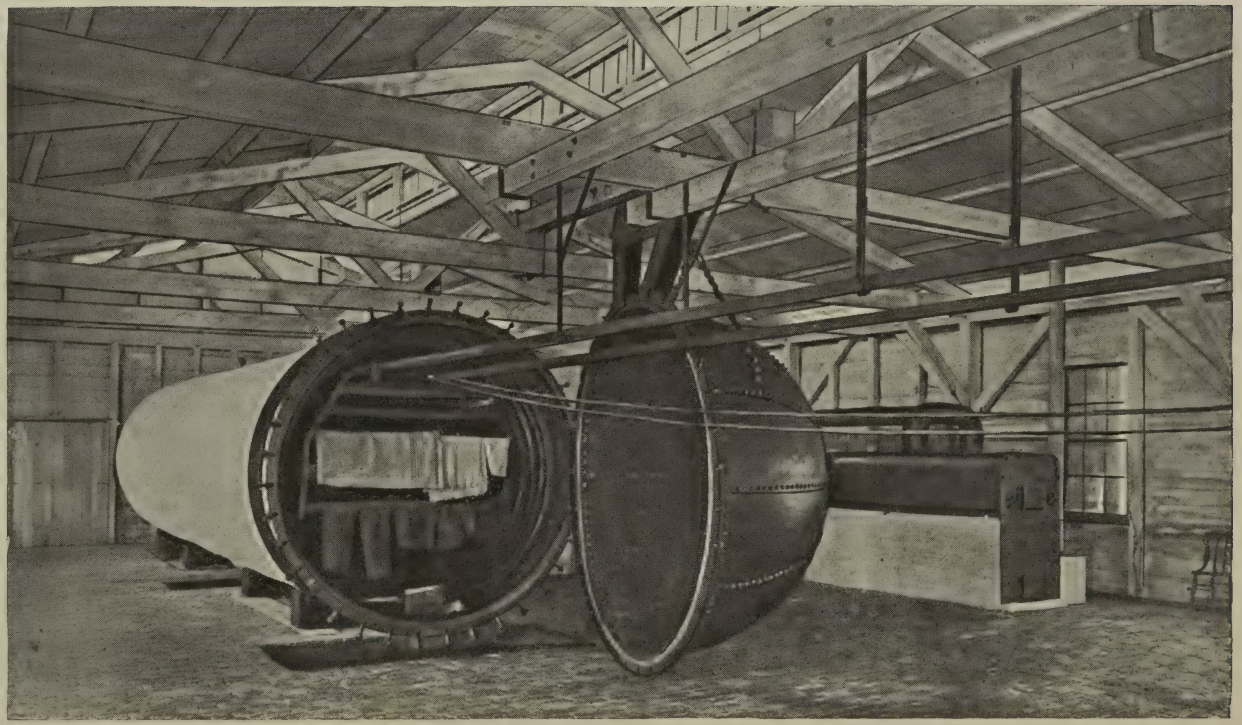
To be brief, I will give the varieties of organisms used in this test and the result of immediate transplantation upon fresh agar-agar:

Bacillus Anthracis, alive, full growth in twenty-four hours.
" Indicus, " " "
No. 1. Sewer mud, " " "
" No. 2,[2] " " "
" No. 3,[3] " " "
Staphylococcus Pyogenes Albus, dead.
" Cereus, "

[1] Pure cultures of this spirillum from a case on Swinburne Island, N. Y., quarantine, were subjected to identically the same conditions as stated above, on November 14, 1892, and with the same result—the destruction of microörganism.

[2] Bacillus Saprogenes.

[3] Bac. Putrificus Coli.



Bacillus Subtilis, alive, full growth in twenty-four hours.
" Mesenter, " " "
" Typhi Ab. " " "
" Coli Com. " " "
" Typhi Abdom, on cotton-wool, alive.

The two following were thickly wrapped in a woollen blanket before exposure:

Bacillus Typhi Abdom, inhibited.
" No. 2. Sewer mud, full growth.

The next test made was that of exposure of similar cultures of the organisms to steam (live) heat for fifteen minutes at 230° F.

As in the above, immediate transplantation from these cultures gave the following results after forty-eight hours:

Bacillus Nos. 1, 2, and 3, Sewer mud, dead.
" Subtilis, alive, full growth.
" Anthracis, dead.
" Typhi Ab. "
" Coli Com. "
" Hog Cholera, "
Bacillus Diphtheriæ (Lœfler's), dead.
" Indicus, "
Staphylococcus, Cereus and Albus "
Bacillus Typhi Abdom, on cotton-wool, dead.
" " " in blanket, "
" Coli Communis " "
" Indicus " "
" Hog Cholera " "

All cultures made from the tubes after exposure were subjected to uniform temperature of 37° C. in the incubator for twenty-four to forty eight hours.

Although extended experience has taught us the availability of heat, and especially of fresh or live steam under pressure, as a disinfectant par excellence, and although we were aware of the general excellence of the quarantine station as conducted by your committee, still there is much satisfaction to be derived from the above shown results, and a feeling of greater security must now prevail.

Reference to the first test will show that the micrococci subjected to 194° F. were killed; but it was only after subjection to the higher degree of steam pressure heat, 230° F., that the spore bearing organisms were destroyed with their spores. The only exception was the Bacillus Subtilis, the common bacillus of hay, entirely innocent, but whose spores are the most resistant known.

In view of the fact that recent authority seems to demand a much less pronounced degree of heat, and at less steam pressure than that which

you utilize at your station in routine disinfection, I cannot close this report without complimenting your committee upon the superb appearance of your station, and the perfect manner in which disinfection is accomplished. Since your apparatus is such that with the same outlay of time and material you can develop a temperature of 230° F., it would only seem wise to continue that temperature as the maximum to be sought at all times.

With much regard, I am, dear sir, yours most sincerely,

EUGENE WASDIN, M. D.,

Prof. Pathology and Histology, Medical College State of S. C.

LII.

CLIMATE OF THE CITY OF MEXICO.

By Dr. DOMINGO ORVAÑANOS,

Member of the Supreme Board of Health of Mexico.

The influence which the atmosphere, the waters, and the locality exercise on individuals when congregated in societies, and living on determined points of the earth, is very positive, and for this reason very important to the sanitary physician of each place. It is also of importance to him to have a thorough understanding of the climate in which his patients reside, this being a very important consideration in the solution of the many problems which affect public health.

In this paper I propose to make a brief study of the principal meteorological data of the city of Mexico in everything referring to its situation, elevation, humidity, temperature, winds, ozone, and light.

Situation.—Mexico (place of Mexitli, God of War) is situated in 19° 26′ 26″ north latitude, and 99° 6′ 45″ longitude west from Greenwich. The greatest width of the city from east to west is 5 kilometres and 53 metres; and the greatest width from north to south is 4 kilometres and 800 metres; the superficial area is 14 square kilometres, without including those grounds on which they are at present forming colonies.

The semi-tropical situation of the city causes the rays of the sun to fall vertically upon it twice a year, while in all the rest of the year they are very little far from perpendicular. The longest day lasts 13 hours 10 minutes, and the shortest 10 hours 50 minutes.

Elevation.—The city is situated at an elevation of 2,268 metres over the sea level. The mean barometric pressure is 586.40 mm.; the maximum in fifteen years has been 594.19 mm. (1879), and the minimum within the same period has been 579.80 mm.

The extraordinary elevation at which this city is situated causes a diminution of oxygen, which, instead of being in the proportion of 0.28331 litres of atmosphere with a temperature of 15°, as at the sea level, is only in the proportion of 0.20685. This means to say, that at each respiration we introduce almost one fourth part less of oxygen into our lungs than the inhabitants of the lower elevations, and this necessarily causes certain physiological and pathological changes in our condition.

As might very well be supposed, all the inhabitants of Mexico ought to suffer a certain amount of anæmia, and for many years this has been the opinion of many intelligent observers, but, nevertheless, the experi-

ments practised during the last few years in this city, by Drs. Cordero, Gaviño, and especially Lope de Vega, appear to prove the following facts: 1. The number of red corpuscles which each individual has is generally rather larger than on the coast. 2. The diminution of oxygen in the air is compensated for by the increase in the number of respirations, which are from 22 to 24 per minute. These same conclusions are deduced from the experiments which have been made lately by Drs. Muntz and Viault, each one independently of the other, and at altitudes of 2,877 metres above the sea level. These experiments were carried out on the "Pic de Midi" and on the summits of the Andes. Dr. Gaviño has also made three experiments to discover the amount of carbonic acid which was exhaled, and obtained a mean of 4.25 per hundred of air, arriving therefore to the following conclusion: In Mexico the production of carbonic acid manifests itself almost in the same proportions of volume as in those places which have a pressure of 76 centimetres, and as this is an indication of the organic combustions, we may conclude that we consume approximately the same amount of oxygen, for which purpose we increase our respirations by one fourth part.

Dr. Coindet came to the conclusion, after various experiments made in the valley of Mexico at the time of the French invasion, that the mean volume of carbonic acid exhaled was 3.96 per cent. among newly arrived Frenchmen, 4.35 per cent. by Mexicans, and 4.51 per cent. by Indians.

But with respect to the results obtained both by Dr. Gaviño and by Dr. Coindet, we cannot but reflect on the remarks previously made by Lombard, that even when the quantity of carbonic acid exhaled might represent the same volume in Mexico as at the sea level, taking into account the rarity of the atmosphere at an altitude of 2,268 metres, we find a remarkable deficit on the central table land as compared with the lowlands.

The results obtained by Drs. Lope de Vega, Muntz, and Viault are not founded solely on a limited number of experiments, and for that reason we await the continuation of these labors so as to be able to form an exact judgment on the point.

Atmospheric Humidity (absolute humidity).—The city being situated at the considerable elevation that we have above mentioned, the general rule follows respecting the amount of water vapor held in the atmosphere which applies to elevated situations—that is to say, it ought to be scarce considering the latitude. So it turns out to be, as the medium quantity contained in a cubic metre per annum is 8.16 grammes, or, measured in milimetres of mercury, 8.24 mm. This amount is small compared with the towns at a lower elevation within the republic, where the tension of the water vapor is 12 to 14 mm. As hot air absorbs a greater quantity of water than cold air, the progress of the tension of the vapor follows an analogous process to that of the temperature—that is to say, it is weaker in winter and more elevated in summer. Thus it is that we see in Mexico a general increase from February to July, and a corresponding decrease from the latter month to the following February.

Respecting the daily rates of tension, the observations follow the same course, which is parallel to that of the temperature, notwithstanding that at midday and in the first hours of the afternoon the lines diverge to a slight degree, caused by the extra elevation of the atmospheric temperature, which carries off a great quantity of water vapor that cannot be quickly replaced by evaporation from the earth.

Evaporation.—The evaporation in the city is extraordinary, the mean by day being 6.6 mm. in the sun and 2.5 mm. in the shade.

Relative Humidity.—The absolute amount of vapor contained in the atmosphere is not of so much importance to us as the relative humidity. The atmosphere may contain a great amount of vapor and appear to us dry, and, on the contrary, it may hold very little vapor and appear to us full of humidity, as our senses can only appreciate relative humidity, and more especially when this approaches the degree of saturation. The progress of relative humidity is in inverse ratio to the absolute humidity, and can be easily understood when we reflect that with the increase of heat in the atmosphere, the latter requires a greater amount of vapor to become saturated. The mean annual relative humidity in Mexico amounts to 61 in place of 75 or 80 that we find at lower elevations. The result is that we have a very dry atmosphere, a circumstance remarkable when we think of the five lakes that are close to the city. In spite of this fact, the atmosphere in this city is as dry as that of Puebla, San Luis Potosi, and other cities of the central table land. Some years ago, when we discussed, in the National Academy of Medicine, the possible evils that might result to the towns of the valley from the drainage of the lakes, I had the honor to read to that honorable corporation a paper, in which I made an extensive study of everything relating to that question, arriving at the following conclusion: "From all this, we find that even if the lakes were a great deal larger than they are, they would hardly increase the hydrometry of the city: Firstly, because it is not situated in the course of the prevailing winds from the north-west; and, secondly, because the winds which pass over these lakes are excessively dry and hot and therefore require enormous quantities of vapor before they arrive to the point of saturation."

From what is above said, it will be easily understood that no prejudice will arise to the hydrometric conditions of the city from the drainage of the lakes.

Dew.—As the nights are generally very clear, especially in spring, and the air is calm, the dew falls in abundance on vegetation of all kinds.

Fogs.—Fogs are extremely rare in this city, although they do sometimes occur in the early spring mornings.

Clouds.—During the winter and the greater part of spring, the sky over the Mexico valley is perfectly clear; we have a few cloudy days in December and January, but they are by no means common. What is commonly observed is a species of cloud cap surrounding the valley and resting on the crests of the mountains, which limit the view. The cur-

rent of air, which rises from the ground through its own heat, becomes rarified as it elevates itself, and for the same reason gives off a great deal of its heat. It also meets with the almost frozen tops of the mountains, which oblige it to precipitate its vapor in the form of clouds. These are most commonly seen in the afternoons, but when night draws on and cools the soil of the valley, the ascending current ceases, the clouds disappear, and the sky remains perfectly clear for the rest of the night.

Rains.—The rains are not very abundant in the valley of Mexico, although as a general rule they are not rare, the mean annual rainfall reaching 614.4 mm., and the number of rainy days averaging 139.

The rainy season can be said to last from June to October, as in the other months of the year we rarely have any rain. The amount of water that falls in each precipitation varies a great deal, being sometimes very excessive, and has occasionally reached 63.3 mm. (1888).

The relative abundance of the rainfall does not prevent our atmosphere from being very dry, and it is curious to observe, after a heavy storm, how the rays of our tropical sun shine afresh, the sky clears, and the air is as dry as before.

Snow.—It may be said that we do not know what a snow storm is, as we only see one about once in every forty years, so that they are hardly worth taking into consideration, nevertheless, we have the pleasure of observing the perpetual snows all the year round on the summits of Popocatapetl and Iztaccihuatl.

Temperature.—We have seen that the atmosphere of the valley is very dry, as happens more or less in all elevated localities. As the water vapor absorbs the caloric, this being so scarce in our atmosphere renders it colder than that on the slopes of our mountains or on our coast. On the other hand, the rarification of our atmosphere by the decrease of pressure in its ascent to the central table land is another powerful cause for the diminution of its heat. That is one reason why our dry atmosphere is always fresher and more agreeable than that of other cities in the republic that are situated in the same latitude as Mexico but at a lower elevation. The elevation of our valley is the principal element of its climate, because, as we say in another part, "The diminished pressure of our atmosphere, which is the cause of the rarification of the atmosphere, of its coolness, and to a great extent of its dryness, is the principal meteorological cause which gives rise to all our thermometrical phenomena." The mean annual temperature in Mexico in the shade is 15.5° C. (59.9° F.). The knowledge of these figures cannot give us even an approximate idea of our climate, seeing that it is well known that there are plenty of places which, with the same annual mean temperature, show a very great difference in the progress of that temperature during the different seasons, during the different months, and generally in the modifications which that same temperature undergoes.

The mean temperature in Mexico during the winter is 12.9°; that of spring, 17.8°; that of summer, 16.6°; and that of autumn, 13.5°. The difference between the mean temperature of the hottest month, which is

April, and January, which is the coldest, is 7.5°. Thus we find that the climate in Mexico can be classed as both temperate and equable, seeing that the annual variation of temperature is exceedingly slight. But if, instead of taking into account the general variations of temperature, we look at the extreme degrees of heat or cold, we find that our climate is also variable. Thus we find that the maximum in the shade for sixteen years has been 31.6° (1878), and the maximum in the sun has been 49° (1878); the minimum in the shade has been 1.7° below zero (1887), and the minimum in the sun, 7.2° below zero (1887). The difference between the absolute maximum and minimum in the shade reaches up to 25° in the course of a month, and the difference between these same maximum and minimum in the sun has reached as high as 53.9°.

The daily progress of the temperature is as follows: The temperature between five and six in the morning is the lowest in the day, and from that point it rises gradually until two or three in the afternoon, when it reaches its maximum, and thence decreases in as gradual a manner until five or six in the morning.

With respect to the daily oscillation and other phenomena incidental to the inconstancy of our climate, we have on another occasion expressed ourselves as follows on the subject:[1] "The daily oscillation has been 21.2° in the shade, and 50.7° in the sun. All the changes of temperature are divided by the mean temperature between the annual mean from 10° below zero at 80° latitude and the annual mean of 32°; consequently between these two extreme temperatures there is a scale of 50°, so that we go through that scale in one single day, as it has been seen, and we can properly say that in one and the same day we experience all the changes, and it seems as if we were conveyed from the Polar frozen regions to the burning zones of Africa.

"This difference of temperature constitutes one of the characteristic features of our climate. In Mexico, with her dry atmosphere, the sun's rays produce an extraordinary heating power, so as to give our soil the appearance of being scorched. When the sun sinks behind the tops of the mountains, the radiation towards the heavenly regions in the valley of Mexico begins; the air, which on account of its dryness is enabled to prevent the heat from reaching the soil, is also enabled to prevent its departing from it, and this takes place with extraordinary frequency. We thus have in Mexico, on one side the burning soil, and on the other, not only in the regions of great altitude, but in the moderate altitude of the valley, perpetual cold. In our region the eternal snow begins at an altitude of little more than four kilometres, as can be seen on Popocatepetl and Iztaccihuatl. The valley of Mexico, as already said, is situated at 2,600 metres above the sea level, and only about two kilometres distant from the eternal snow—that is to say, as distant as a town would be that were situated 50° or 60° latitude."

Frosts are very frequent in the valley of Mexico, and as they always

1 The Federal District in the Republic of Mexico as a suitable place for persons predisposed to tuberculous affections and for relief of pulmonary consumption. Public Health Reports, vol. 16.

take place with a clear and transparent atmosphere, the rays of the sun beat on our bodies to an excessive degree, while in any other place, perhaps only a yard distant but in the shade, we feel a remarkable degree of cold.

I have myself experienced a cold of 15° C. below zero in New York, and have felt it less than in the city of Mexico with a temperature of one or two degrees above zero, and this is because the irradiation of our bodies is very rapid and extraordinarily intense during a heavy frost. Fortunately, these are not very frequent, and when they happen the cold is only felt for one or two hours in the morning and evening. In all other respects the city of Mexico is a place well adapted for winter residence, seeing that here we have not the excessive and continued cold waves of the north, or its snows; but it is even a better summer residence, on account of the absence of the excessive heat found in the more northern countries. In Mexico we require some covering over our beds during the whole year; on the days of greatest heat we have some delightfully fresh mornings, and even on the coldest days we do not require any fires in our houses. It will therefore be easily understood that our city is a pleasant residence in winter, and although it appears a paradox to advise the inhabitants of the United States and Canada to take a journey of several thousand kilometres to the south during the month of July, the fact is that they will find in these tropical latitudes elevations of two or three thousand metres, with a fresh and agreeable temperature.

Winds.—The prevailing winds in Mexico are from the north-west. The breeze in the city is generally slight, its mean velocity per second not going beyond 0.8 m., and the maximum velocity that has been observed up to date is 21 mm. (1886). The strongest wind is that which comes from the north-east. With regard to the humidity of each one of these winds that blow over the city, we can give them these respective positions: 1. North-west; 2. west; 3. south-west and north; 4. south; 5. south-east; 6. east; 7. north-east. Their respective temperatures, beginning with the coolest, can be rated as follows: 1. North-west; 2. west; 3. north; 4. south-east; 5. south and north-east; 6. east; 7. south-east.

Ozone.—The annual mean quantity of ozone in the air of the city is 4.2, but as the methods that have been hitherto discovered for determining the amount of ozone in the atmosphere are defective, I will not enter further into this subject.

Light.—The geographical situation of the city and its great altitude are the causes of the extraordinary intensity of light in its atmosphere. The rarification of the atmosphere and the water vapors, as we have above shown, being very scarce, the solar rays exercise on the ground their full luminous, calorific, and chemical powers, unimpeded by any disturbing influence.

The interesting observations carried out by Downs and Blunt[1] on the

[1] Proceedings of the Royal Society, vol. 26, 1878.

effect of light on bacteria and other organisms, which are perfectly developed as well as on the protoplasm, has brought to our knowledge some most interesting facts with regard to this question. By exposing to light the Pasteur solution, urine and infusion of hay, and afterwards depriving them of light, we find that this agent is not favorable to the development of bacteria and of microscopic spores, which are produced during putrefaction. It has also been noted that the direct rays of the sun act in a more powerful manner than when they are diffused, and that the germs already developed can be destroyed by the sole influence of solar light.

Doubtless it is to this benevolent influence that we owe our almost total exemption from tuberculosis and the fact that when found among us it takes such a very mild form, also the fact that the greater part of the infectious diseases are either rare among us or entirely unknown.

It is to this beneficent influence also that we have the pleasure of seeing you again in our own country, and we do not doubt that in your own hearts you will always preserve a sincere affection for and desire to see the beautiful light, as well as enjoy the delicious climate, of the picturesque valley of Mexico.

LIII.

NOTE ON HERPES-TONSURANS.

By ALFRED E. REGENSBURGER, M. D.,

Member of the Public Health Association, Vice-president of the San Francisco Bacteriological Society, Member of the California Academy of Medicine, etc.

San Francisco, Cal.

Mr. President and Fellow-Members of the American Public Health Association: As is well known the trichophyton, first described by Gruby in 1844, and by Malmsten in 1845, is the etiological factor in the production of one of the most common and most intractable, as well as the most contagious, of cutaneous diseases dependent upon a vegetable parasite or fungus. It may affect any portions of the cutaneous envelope, those covered with hair and those which are entirely smooth, while the nails are not spared its ravages. Owing to the varied clinical pictures which it presents according to the situation occupied, it has been described under many different terms, the ones most commonly employed to designate which region is involved being here given: trichophytosis capitis or herpes tonsurans, when the scalp is the part invaded; trichophytosis unguium or onychomycosis, when the parasite has attacked the nails; trichophytosis barbae or sycosis parasitica, when the beard suffers from it; trichophytosis cruris or eczema marginatum, when the locality of the crotch is the one that has made its acquaintance, and finally trichophytosis corporis or tinea trichophytina corporis when the non-hairy parts of the patient's skin are concerned. It is oftenest only one form with which the subject is afflicted. The heads of children being especially prone to it, giving rise to herpes-tonsurans. It is to this variety to which these few remarks are limited. "Ringworm of the scalp in children is confessedly so obstinate a disease in the majority of cases that it claims our attention first," says Jamieson when speaking of parasitic affections of the skin. Thin tells us that in the common schools of London it has been "a great evil with which it has been hardly able to cope." Paris has in its great hospital for diseases of the skin, the *Hôpital St. Louis*, a special division set apart for the treatment and care of those suffering from it. The mention of these few facts as stated above, gives but a faint idea of the importance of this matter from the standpoint of public hygiene and is my excuse for claiming a few moments of your attention for it in this place and at this time.

It is almost entirely a disease of children. Adults are rarely affected by it. Both my illustrious teachers, Professors Hardy and Lailler, con-

tended that in their extended experience they never saw a person over twenty years of age who had this disease. Brocq, in his work on "Le traitement des maladies de la peau," claims to have encountered one case of it in a young woman. In my own observation I have never met a grown person who suffered from it. Like all similar parasitic ailments it is very contagious, indeed more so than most others—a great deal more than favus and pityriasis versicolor. Occurring in children, at a time of life when the individual is little or not at all concerned with the importance to himself or to others of his sanitary condition, and when educational requirements exact aggregation and close contact, it follows that its recognition at the earliest possible moment is of the greatest importance and necessity, to prevent its spreading to others and invading entire asylums, schools, workshops or other places, where susceptible material is present, thence being carried into families and disseminated throughout entire communities. Without going deeply into its symptomatology, the early itching, which soon directs attention to a small circular patch or patches on the scalp covered by scurf,—the pityriasis alba parasitica of some authors,—having a diameter from one half to several inches, and later on, the nibbled off hair, the ends thickened and broken off a short distance from their emergence from the skin, and finally the circular spots or patches of baldness, should cause a suspicion of the true nature of the trouble. In the language of T. Fox,—"Whenever, then, in the scalp a circular patch of disease and thereon short broken off hairs appears the microscope will give plenty of evidence of disease." It may be laid down as a golden rule to examine the hairs and scales in every suspected case. This is done easily enough. It should never be neglected. It is well to place the hair to be examined in a little liquor potassae before putting it under the microscope. With a glass magnifying from 250 to 300 diameters the fungus is seen to consist of roundish oval spores, refracting the light strongly, .003 to .007 mm. long by .003 to .004 mm. broad and with mycelial threads which are articulated and slightly undulated. The spores predominate in quantity, the mycelium being sparse, and in some cases seemingly absent or difficult of detection. In the absence of a microscope or unfamiliarity with its use, Duckworth's chloroform test may be had recourse to. It is used by placing a hair in a glass slide and enough chloroform dropped on it to float the hair; the chloroform is allowed to evaporate, when the hair will be found to be of a chalky white color. No other disease gives this reaction. With this test and the microscope at our command there is little excuse for this trouble not being recognized. We, in California, have had very little of the disease. I can count on my fingers the number of cases that have come under my notice during a professional life of about eighteen years in this state. This may perhaps be accounted for partly on the theory that our people are better housed, better clothed, and better fed, and that consequently being in a better sanitary condition, the disease does not find such a suitable soil to take root and thrive on. A further reason can also be seen in the well known fact that the disease is com-

municated from domestic animals, such as the dog, cat, pig, and horse, and that our rural population does not live in such intimate contact with them as they do in countries where the disease prevails very severely and often. It has been said that most of the cases which find their way into the hospitals in large cities originate in the country. In places where the disease is seldom met with, special vigilance is requisite that it be at once diagnosticated and not be overlooked and thus form a focus for its propagation to others. It goes without saying that the instant it makes its appearance, the affected person should be subjected to proper medical treatment, and the necessary prophylactic measures taken without delay, to prevent its spread. It is beyond my province here, to touch upon the therapeutic means to be applied; that is not within the scope of this paper, but I shall devote a few words to it as far as it relates to public hygiene. Isolation is the first thing to be done. Quarantine, as it were, the patient. Allow no toilet articles to be used promiscuously, or any head coverings of the patient, by others. Bearing in mind that domestic animals may be its carriers, care should be taken that none such are around as, if affected, they may prevent a speedy recovery and if free from it, they may in turn become infected by the child playing with them thus retarding the cure and becoming an element of danger to others.

An important question to be answered is, When is the child to be allowed to mix with other children; in other words, when is it to be kept no longer isolated? In general terms it may be stated, As soon as the child presents no evidences of the disease, both to the eye and to the microscope, and that, after repeated examinations made at intervals of several days; then only after it has remained well for some weeks. This may do as in general. However, the question must be answered in every individual case for itself. No matter what importunities may be used, or what influence brought to bear, the child must not be permitted to resume its usual mode of life and mingle with other children until the medical practitioner is firmly convinced that all danger of contagion is past. He must not allow himself to be swayed by the entreaties or supplications of the parents or other interested parties, but, Prometheus-like, tied down and welded to the sanitary welfare of the community whose health is in his keeping by virtue of his exalted calling, he must do his duty, though it be unpleasant and disagreeable at times, in a kind, honest, and courteous manner. Before a child is received into any public or private institution in localities where it is present, it should be an inflexible rule never to be departed from, to demand a medical certificate from competent medical authority attesting the freedom of the child from the trouble. Even then those in charge of children should be on the alert for the slightest appearance or reappearance of any symptom of it; and if any suspicion be aroused, the matter should be referred immediately for an opinion to a competent physician as to what is to be done. The importance of the trouble in the way of causing not only, to the one affected, bodily inconvenience,

but at the same time making him a menace to others of his age with whom he may be brought into contact, and also being the means of causing a vast deal of mental worry and pecuniary loss to those in charge and owning schools, asylums, and the like, suggests the enactment of laws to aid the sanitarian in minimizing if not extirpating this, in some places, veritable scourge.

LIV.

STATISTICS OF MORTALITY IN THE CITY OF MEXICO.

By Dr. EDUARDO LICÉAGA,

President of the Superior Board of Health, Etc.,

Mexico.

In the year 1890, 16,590 persons died.

According to the census, which we have already spoken of, on the night of the 11th to 12th of October of the same year, there were 326,594 inhabitants, but in round numbers we compute it at 326,000 and also in round number, the proportion of mortality is 50.8 per thousand. This number is excessively high if we compare it with one of the large cities in Europe and the United States that have an equal or larger number of inhabitants.

Wards.	Census.	Mortality.	Proportion per 1,000 of the mortality had in each ward in 1889, according to the census.
I	40,855	1,956	47.8
II	67,238	4,065	60.4
III	65,142	3,497	53.6
IV	48,204	1,731	35.9
V	42,381	2,089	49.2
VI	34,597	1,201	34.7
VII	18,512	703	37.9
VIII	9,665	194	20.1
Totals	326,594	15,436	

The object of the study that we undertake is to investigate, as far as possible, the causes of this high mortality and the manner of diminishing it.

The final results of work made the 12th of October, 1890, for forming the census of the city of Mexico, revised the 6th of November, and the proportion of mortality according the year 1890, are as follows:

The mortality was not uniform in the different months of the year as the graphic table marked with the number I shows. In it can be seen that the greatest mortality corresponded to the months of January, February, April, March, May, and December; from there it commenced to decrease in the months of June, August, November, October, September. The month of the greatest mortality was January with 1,921, and that of the least was September, with 1,107.

In the months of January and February a part of the increase in mortality is explained by the epidemic of influenza which then reigned in the city. The consequences of this epidemic were still felt in after months, as we will show later.

The order in which different diseases caused mortality is as follows:

Affections of the digestive organs	4,326
Affections of the respiratory organs without counting the tubercular	3,992
Constitutional and zymotic diseases	3,605
Affections of the nervous system	1,681
Causes, not necessarily associated with local or constitutional diseases	1,252
Diseases of the circulatory organs	753
Accidents	306
Affections of the genito-urinary organs	198
Alcoholism	290
Affections of the skin and cellular tissues	37
Affections of the bones and articulations	6
Unknown causes	133

The complaints being taken separately in order to know the mortality that corresponds to each one, I have divided them arbitrarily in two groups, whether they have caused more or less than a hundred deaths in one year.

The graphic table No. III represents the first group.

I ought to mention that the necessary imperfections of the diagnosis in the books of the civil register has obliged the Board to form a conventional group of the diseases that are designated under these names: colitis, enteritis, entero-colitis, without specifying the cause that has produced them. This group comprises 2,669. (Table No. VII.)

This number which appears to be the highest of the mortality, does not only represent special complaints of the digestive organs but many constitutional affections, such as tuberculosis, alcoholism, and those that come at the termination of many other general complaints.

It is very difficult to tell the precise number that corresponds to each of these causes; but whatever it may be, it ought to be deducted from the former figure, and that deduction made, there will still remain a number sufficiently high.

In a former statement I pointed out some of the causes of affections of the digestive organs and the manner of preventing them. This consists in preserving drinking water supplied to the town with the purity that it has at its source, and preventing any impurities from mixing with it on its way to the houses; in being more vigilant over food and drinks. One of the most important chapters of the sanitary code refers to the manner of keeping this vigilance, and another to the imposition of fines to the adulterators and falsifiers of articles of food and drink. The persecution of adulterators of milk has been a very good result.

The stagnation of water in "square fosses" is another of the factors of production of diseases of the digestive organs; this will entirely disappear when the project of canalization of the water of the city is realized, and the improvement has been marked since the draining pumps of the canal of San Lázaro were established.

The mortality of children from intestinal affections is due to premature weaning, to association of food unsuitable with lactation and to the ignorance of the uneducated class of society, who do not attend to these affections promptly and properly. In adults, intemperance; the bad quality of food used by the low classes; and in the middle classes, the irregularity of meals, the substitution of sweets for good food, and above all, the use of alcoholic drinks, contribute to the profound disturbance of the digestive functions. Private hygiene makes known the rules that ought to guide man in the use of food and drink, and doctors can contribute greatly by inculcating their precepts in the families they attend; public administration can make this teaching obligatory in all schools, and hygienic doctors propagating this kind of knowledge, by means of clear and simple instructions in the medical journals and the press in general, will efficaciously contribute to diminish the mortality caused by iutestinal affections.

Table No. I marks the difference of mortality in the months of the year.

Affections of the respiratory organs have caused the death of 3,992 persons. We have already said that pulmonary phthisis is not included in this group; if it were we should have to add 1,058, and seventeen that correspond to laryngeal phthisis, and we should reach the number of 5,067—higher than that of intestinal diseases. (Table No. IV.)

There are three diseases that raise this figure:

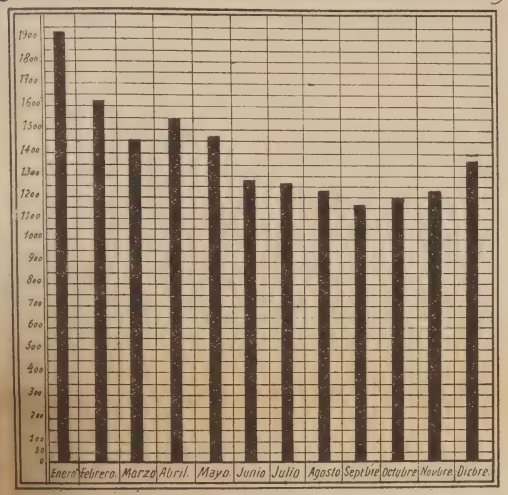
The first is pneumonia with	2,358
Pulmonary phthisis, which we have already indicated . .	1,058
Bronchitis	1,055
Pulmonary congestion comes in the fourth place with . .	165
Pulmonary emphysema	147
Pleurisy and its consequences only	83

We will not mention other affections of the respiratory organs because they figure with very small numbers.

As we announced at the beginning the increase of mortality in the first months of the year, ought to be attributed to the epidemic of the influenza which then prevailed. In the mortality table influenza is hardly mentioned because the deaths caused by it directly were very few; but the infectious character that it gave to bronchitis and pneumonia made these terminate in death. Influenza gave a fatal tendency to emphysematics. It awakened any hereditary predisposition to pulmonary phthisis; in some persons it revived complaints that had nearly disappeared; it aggravated all illnesses that were fully developed, and was the determining cause of death in those persons who had rooted consumption.

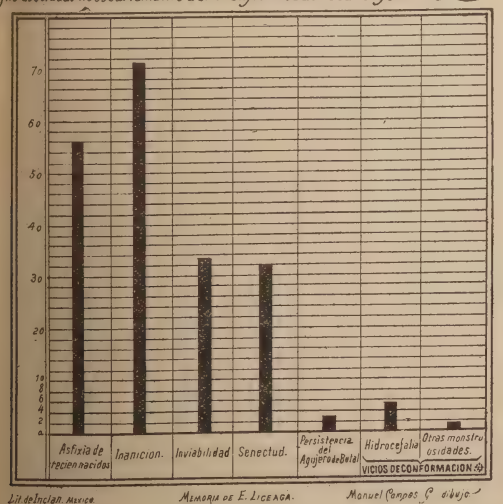
I.

Cuadro comparativo de la mortalidad habida en los meses del año de 1890



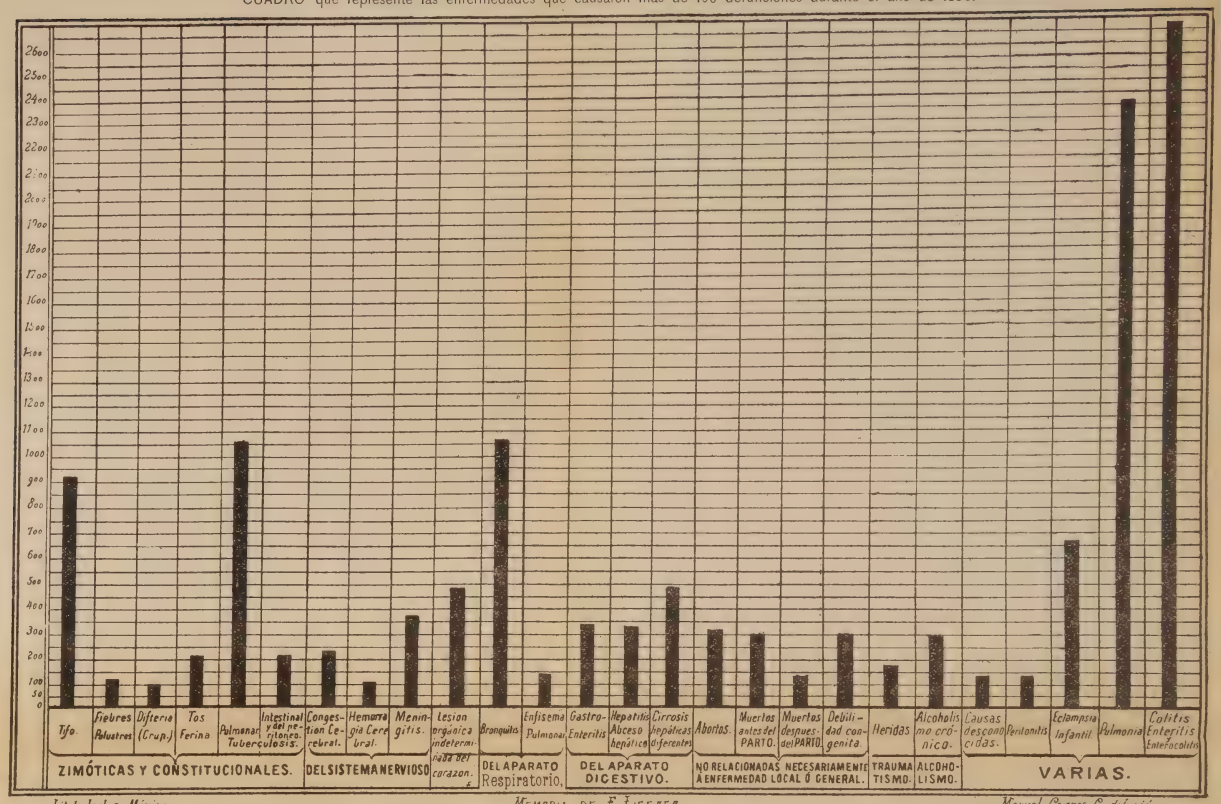
II

Cifras no asociadas necesariamente á una enfermedad local ó general



Lit de Inclan. Mexico — Memoria de E. Liceaga — Manuel Campos G. dibujo

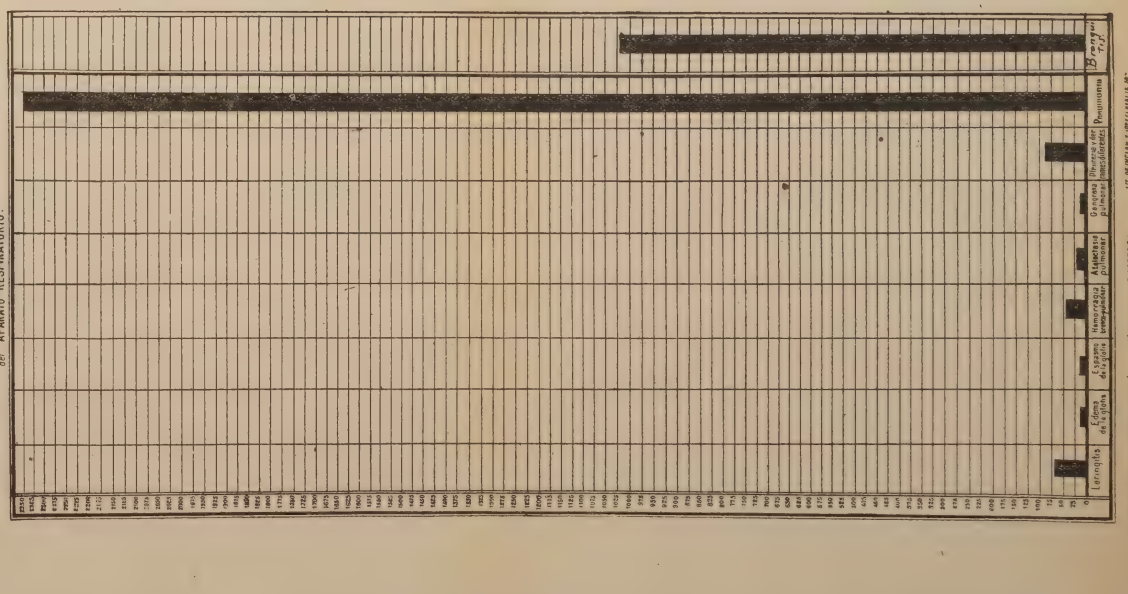
CUADRO que represente las enfermedades que causaron mas de 100 defunciones durante el año de 1890.



Lit de Inclan. México — Memoria de E. Liceaga — Manuel Campos G. dibujo.

IV.

Cuadro que manifiesta la mortalidad causada durante el año de 1890 por las principales enfermedades del APARATO RESPIRATORIO.



Manuel Campos Galvan Dibujo — Memoria de E. LICEAGA

I make this explanation to account for the increase of mortality from diseases of the respiratory organs in the year 1890, and not to cast an additional shadow on the mortality table of this complaint, for it is already sufficiently dark.

Leaving pulmonary phthisis on one side because we will mention it on studying the other tubercular diseases, we will commence by inquiring into the causes that make pneumonia so common. It is a fact proved by statistics that this is a very common illness in all great towns of whatever latitude or topographical conditions; this sole circumstance would be sufficient to make us presume that it is infectious, but the studies of bacteriology tend more and more to demonstrate this truth and physicians of all countries have accepted it because it explains, better than any of the hypothises formerly admitted, all the facts connected with the history of pneumonia. Hygiene has to appropriate this idea as it has appropriated that of the microbial nature of tuberculosis. Dr. Sternberg has made very important studies which will lead to results as certain as those obtained for pulmonary phthisis.

It is probably because pneumonia is an infectious disease that it is observed to be more common in certain seasons of the year. The minimum of the disease was in August, when there were sixty-one deaths; it maintained the number in September, increased a little in October, and went on increasing in the months of November and December and reached its maximum in January and February, and then went on descending during the months of March, April, May, and June.

In all times and in all countries cold has been considered the most powerful cause of pneumonia. But modern studies, indicating it only as an occasional cause, give ample room to hygiene to prevent it. I have said already in former statements—but I shall not tire of repeating it—that the changes of temperature that we have every day in our climate, subject our tissues to every variation it is capable of feeling from cold to heat, not only by its direct action on the economy, by means of the nervous system. To prevent this influence it is indispensable to be well covered in the morning and evening in cold weather; and persons who have delicate lungs should use thick woollen under-clothing during the summer. The habit of changing clothes after taking violent exercise or walking in the sun is injurious because it produces a sudden coolness which is not compensated by the after reaction.

Before continuing the study of the other illnesses we will present a table of comparisons of the relative frequency of the diseases of the respiratory and digestive organs—Table No. VIII, by which it will be seen that those of the respiratory organs increased from August to January, when they reached their maximum, to decline progressively to July, and those of the digestive organs began to increase in February, reached their maximum in July, and gradually declined in the winter months. The fact that the latter diseases increase in the rainy season and those of the respiratory organs in dry weather and during the winter, is repeated with such pertinacity each year that they must obey fixed and invariable rules.

The different forms of bronchitis determine a mortality of 1,055. If we put aside the number that corresponds to the bronchitis of consumptives, of emphysematics, which are symptomatic of measles, of influenza, of whooping cough and of some pulmonary affections, the rest, without doubt, belong to infectious bronchitis. In effect, like the studies we have just made of pneumonia, it grows in the same way,—reaches its maximum in January, and declines until the month of July, when it has its minimum. If we have admitted the surety of an infectious character in pneumonia we must accept in the same manner that of bronchitis and apply to it our series of considerations.

Of the 1,055 deaths from bronchitis, 695 are in the first ten years of life, and of these 497 in the first year, 117 in the second, and the rest in the other ages.

Tubercular diseases, from a total of 1,351 :	
Corresponding to pulmonary phthisis	1,058
to intestinal diseases and peritonitis . . .	205
to meningeal	55
to that of the larynx	17
to acute, miliar tuberculosis generalized . .	14
Other forms not specified	2
Total	1,351

It is certain that the real number of tubercular diseases is not represented in the above figures, and they ought to be augmented with many of the deaths, that are at present attributed to diseases of bones, of the articulations, of the pleura, of the testicle, etc.

In the last statement, remembering that inheritance is one of the most powerful causes of propagation of phthisis, we indicated the advisability of great thinkers making a study of the question of prohibiting marriages between persons who are suffering from tuberculosis. This would be a prophylatic means of incontestable efficacy, and it is the duty of all doctors to point it out when we are opportunely consulted by families. If, by means of the press, religious authority, and books and familiar conversations, it is possible to make people understand that marriages between consumptives are undesirable and unfortunate, one barrier will have been placed against them. The sons of phthisical people die of meningitis at an early age or of mesentericus tabes. Those who escape these succumb to pulmonary or cerebral granule, to tuberculization of the bones or articulations; or, if they live to adult age, will have pulmonary phthisis, or that of other important organs.

The discovery of the bacillus of Koch as the germ of tuberculosis, has given the idea that the facts attributed to inheritance might be explained by contagion, but they would on no account diminish the importance of the factor we have pointed out.

Tradition, at least in Mexico, has planted the idea among the lower classes, of phthisis being contagious; the works of Villemin, in 1865,

demonstrated that tuberculosis could be produced artificially by tubercular inoculation on healthy annimals. Klebbs first, and then Cohnheim, considered the disease infectious, even though they could not explain how it was transmitted; but in 1881, Richard Koch, discovering the bacillus of phthisis, proved at the same time that this was the germ manifestation called scrofulous and *lupus*, and that by it, it was communicated from the sick to the healthy man or animal. Once in the possession of this truth it remained for science to discover the means of transmitting the morbose germ, and in this sense it has been ascertained that the commonest manner of infection is by absorption through the respiratory passages, where it enters by direct means, but especially by the germs brought by the air from desiccated saliva. The intestinal passage is also a means of introducing Koch's bacillus by the injection of animals sick with tuberculosis or *Pommelière*. It has been proved that the tuberculous nodes of the dugs of sick animals impregnate the milk with tubercular bacillus; this enters through cuts or cracks in the skin and produces lupus or lymphatic ganglions, or that adenitis which has been considered so characteristic of scrofulous affections. It is very probable that the tuberculosis of the genito-urinary organs, which has been considered a primitive disease, is also the result of direct transmission.

When one considers how many doors there are for the introduction of the bacillus of tuberculosis, it is surprising that this illness has not spread even more than it has in reality. If it is true that not all who expose themselves to the illness take it, it depends on the facts pointed out by Koch, that the tuberculosis bacillus grows very slowly, and that probably the human organism requires a certain number of conditions to make it fertile ground for the bacillus, and probably also it has numerous resources to expel the germs before they have time to grow.

Hygiene is possessed of these facts and recommends the isolation of phthisical patients,—does not allow their saliva to be left any where, but obliges them to deposit it in basins containing water. As there are climates where tuberculosis does not grow, these ought to be sought by patients as sanitary stations. It has been proclaimed that the confinement in which formerly patients were kept, is prejudicial to them and to those around them, and ought to be substituted by fresh, pure air.

Speaking of climates our country can supply all the varieties that can be found in others. Our coasts of both seas, situated in the tropics, very warm owing to their situation, humid and low, are most fertile for the growth of the tubercular bacillus; in our States of Yucatán, Campeche, Veracruz, etc., phthisis is very common, and is developed with great rapidity.

In proportion as the ground rises above the level of the sea, the physical conditions become less favorable for the development of the microbe of phthisis and the illness is less frequent among the inhabitants.

In the central plateau of Anahuac the conditions for the existence of Koch's bacillus are more precarious than in the zone that we have just

mentioned, and it presents the notable fact that if it does not give an absolute immunity to its inhabitants, it is extraordinarily good for patients who contracted the disease on the coasts of the Gulf or the Pacific.

The higher the altitude the less favorable the place for the development of the bacillus of tuberculosis. According to the elevation above the level of the sea and the graduations that I have just established, they almost correspond to those of the altitude between 1,000 metres and 3,000 metres.

In an inverse proportion the most favorable climates for phthisical patients are the most elevated, and our cities of Zacatecas and Toluca are the most favored from this point of view.

The valley of Mexico presents a combination of circumstances so propitious for the cure of tuberculosis contracted in other places, that it would be of the greatest benefit to establish a sanatorium in the suburbs of the capital.[1]

Finally, preventive hygiene consists in preventing predisposed individuals from being near patients, and in living in climates unfavorable to the growth and life of Koch's bacillus, and to guard against the transmission of the illness through food and drink.

Typhus caused 921 deaths during the year. The graphic table No. VI represents the mortality corresponding to each month. By this it can be seen that the minimum was in September, the maximum in March, and then it gradually diminished till August.

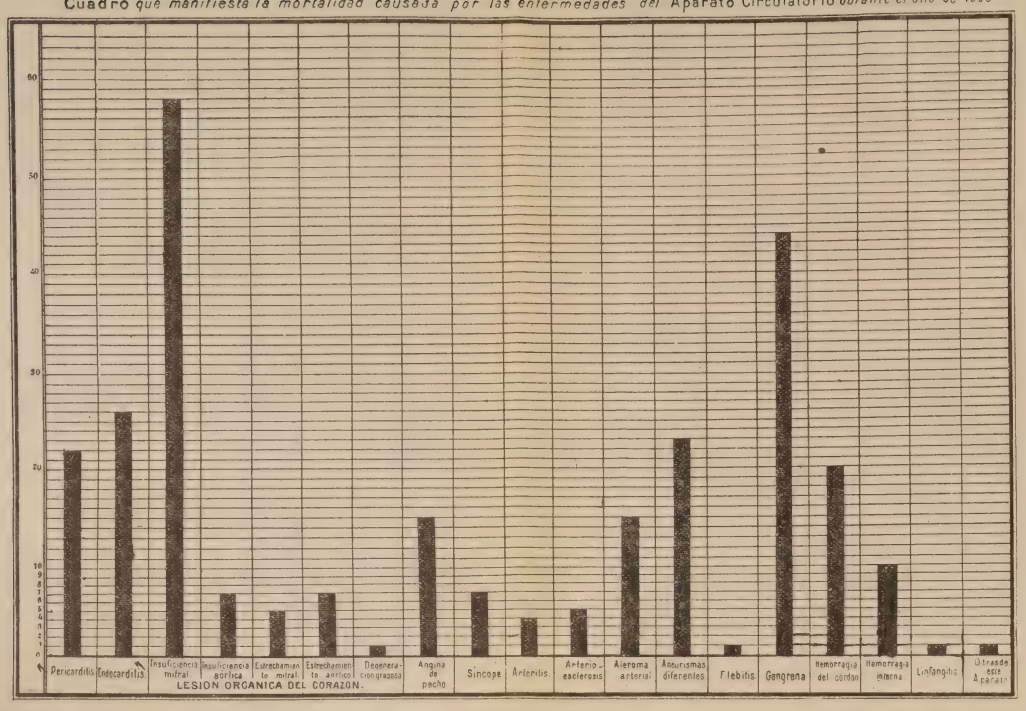
This disease, evidently infectious, has become endemic to the capital. To conquer it, the articles of the sanitary code were put in practice; these are now in force, but at that time were only on trial.

The carrying of typhus patients in cots is defective, but much worse is it to take them in coaches destined for public service, and so pass the illness to healthy persons who afterwards use the same coaches. To obviate this defect it was asked of the Superior to authorize the construction of a special carriage for this service. It is a closed carriage with the entrance behind; on each side are seats for the patients, seats that can be converted into beds for those who are obliged to lie down; all the interior of the coach is painted in oil, and can be washed and disinfected after having been used. Authorization was asked and obtained of the Superior to construct two barracks on an ample piece of ground existing in the Juarez hospital, between the wards and the amphitheatre, but at a great distance from the latter. These barracks would be destined to receive the typhus patients, so that they would not have to be lodged in the wards of the same hospital which they now occupy. These slight constructions can be destroyed after having been used; they permit the isolation of this kind of patients from the rest of the patients in the hospital. They should be provided with special furniture that could be easily disinfected and clothes should be made only to be used by typhus patients.

[1] At the Berlin International Congress of August, 1890, a lecture was delivered upon this topic by the undersigned.

V.

Cuadro que manifiesta la mortalidad causada por las enfermedades del Aparato Circulatorio durante el año de 1890



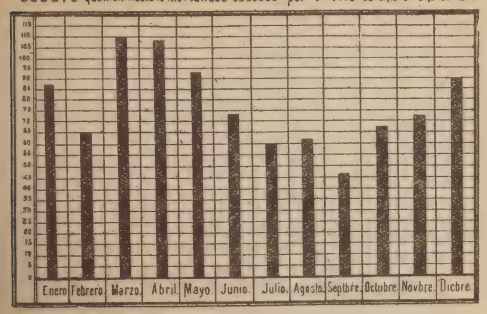
Lit. de Inclan. S. José el Real 16. Mex.

Memoria de E. LICEAGA.

Manuel Campos G. Dib.

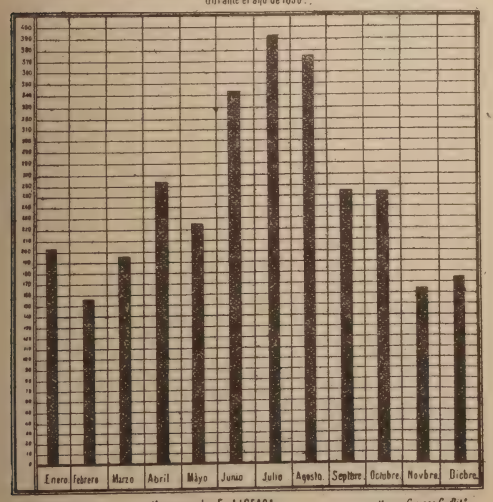
VI

Cuadro que manifiesta la mortalidad causada por el Tifo durante el año de 1890.



VII

Cuadro que manifiesta la mortalidad causada por Enteritis, Colitis y Entero-colitis durante el año de 1890.



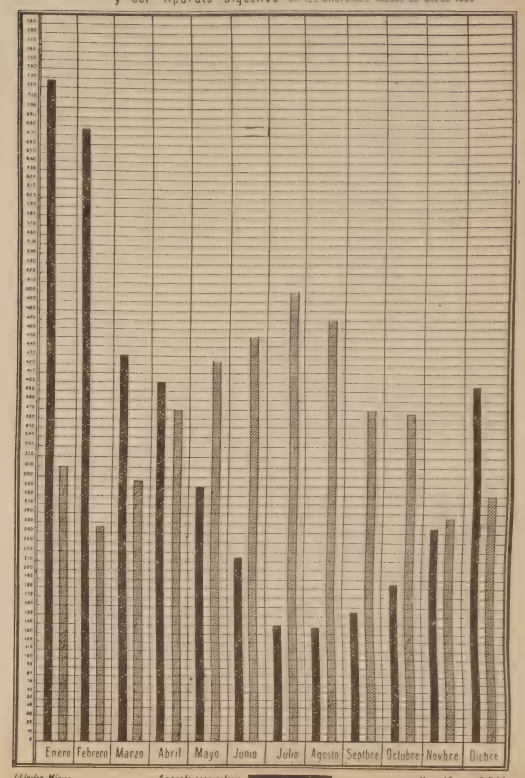
LIT INCLAN MEXICO

Memoria de E. LICEAGA.

MANUEL CAMPOS G. DIB.

VIII

Cuadro comparativo entre la mortalidad causada por enfermedades del Aparato Respiratorio y del Aparato Digestivo en los diferentes meses del año de 1890



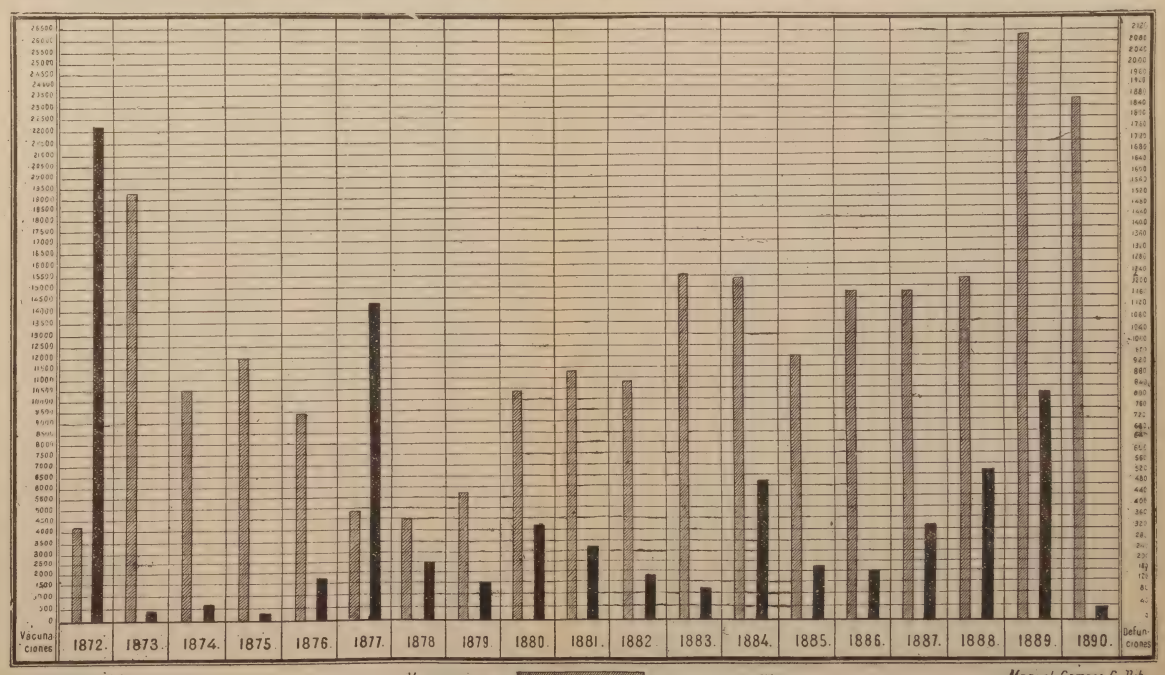
Lit. Inclan, México.

Aparato respiratorio
id digestivo

Manuel Campos G. Dib.

Memoria de E. LICEAGA

CUADRO comparativo entre las VACUNACIONES hechas los años de 1872 a 1890 y las defunciones causadas por la VIRUELA durante el mismo periodo de tiempo.



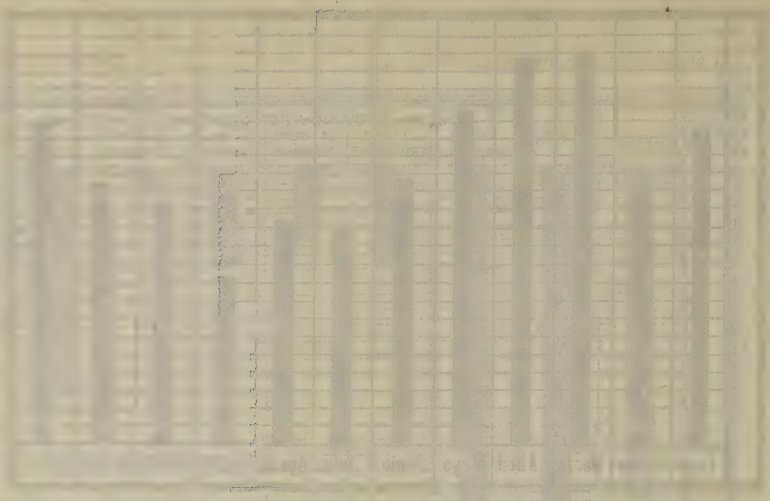
Lit. de Inclan Mex.

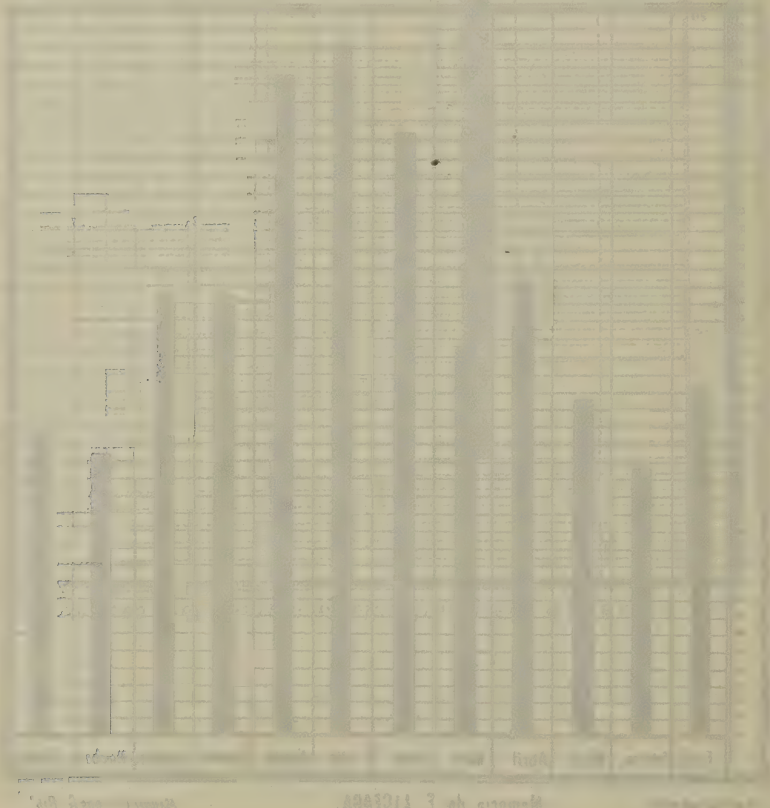
Vacunaciones

Defunciones

Escalas --- 1 = 250 / 1 = 20

Manuel Campos G. Dib.





One of the barracks was raised, according to the model given by the Council for the provisional hospital for cholera patients, but it was never occupied, and the beds, mattresses, etc., provided for it were passed into the wards of the hospital.

The disinfecting stove brought from Europe in 1888 by the undersigned, had not been placed on account of the difficulty of finding an appropriate place for it in this centre of the city and near the offices of the council, but as its installation was indispensable to complete the measures destined to conquer the typhus, authority was asked for and obtained from the secretary of the Government to place the stove in the same Juarez hospital in such a position as to permit its use without injury to the patients or the employés of the establishment. The infected clothes are taken in a special cone, and a different one serves to take them back when they are disinfected. The disinfection service works with regularity.

Instructions on private hygiene and the measures taken by public hygiene to diminish the growth of, and the mortality by, typhus were submitted to the consideration of the Secretary. Approved by him, they were made known to the public by fixing them in the streets, on public buildings, on commercial houses, lodgings-houses, etc.

The diseases of the circulatory system are represented in the general table of mortality by 753 deaths; of these, 558 corresponded to organic injuries of the heart; 26 to endocarditis, and 22 to pericarditis. The first group is sufficiently important to oblige us to make some reflections. Analyzing the numerous causes that originate these diseases, we find in the first place, acute endocarditis, articular rheumatism, deforming arthritis, gout, syphilis, alcoholism, poisoning by nicotine, etc. This enumeration indicates the series of resources that can be employed by hygiene to prevent these illnesses, to whose seriousness the considerable altitude of the city of Mexico contributes. (Table No. V.)

Among the causes of rheumatism are living in low and damp houses, frequent exposure to damp, sudden cold, and certain kinds of food. These causes can be avoided by people of comfortable circumstances, giving them the knowledge of private hygiene and of the necessity for them and the lower classes to persevere in applying the precepts on the hygiene of houses contained in the sanitary code.

A disposition to rheumatism being hereditary directly, or what is more common, the inheritance of some illness that has little relation to it, hygiene can intervene efficaciously, giving advice to modify the constitution of individuals predisposed to it. Obesity, bilious lithiosis, certain diseases of the kidneys, diabetes, and gout are so little related to each other that one is seen to succeed the other in the same individual, or his descendants. They all depend on a perturbation of the nutritive functions, which obey well determined causes, and can be modified by substituting a sedentary for an active life, increasing or varying bodily exercise, marking the kind and quantity of food, establishing a conven-

ient equilibrium between the work of the body and that of the mind, changing, if possible, the very manner of living.

The disease which, after those already mentioned, has the highest figures in the table of mortality (478) is cirrhosis. Although this can come from different causes it is most frequently produced by the slow poison of alcoholic drinks.

Hepatitis and abscess of the liver, which are its frequent consequences, are represented by 30 deaths. Suppurated hepatitis is an illness common to our climate. It is most frequently caused by the abuse of pulque, immoderate eating of food difficult of digestion and at the same time stimulating, such as duck, *mole*, *enchiladas*, *carnitas*, etc. The sanitary authorities can of course look after the good condition of food and thus contribute to efface that cause of illness; on the other hand the best education will inculcate in every individual the precepts of private hygiene, and there is no doubt this will diminish the number of deaths from that cause.

Three hundred and thirty-eight is the figure corresponding, in the table of mortality, to the deaths caused by gastro-enteritis. It will be easily understood that in this group are included some illnesses, of which catarrh of the stomach and intestines are only symptoms; but even discounting these, there would still remain a considerable figure, whose principal cause is the eating of improper food, as happens in the greater part of the complaints of children; while, in adults, it is caused by intemperance and gluttony. When the knowledge of private hygiene has extended and the benefits of soberness and temperance become better known, this figure in the mortality table will be seen to diminish and then disappear.

In our classification there is a grouping of causes of death that have nothing in common more than the circumstances of not being necessarily associated with a local or general disease, but which have the greatest interest for persons interested in hygiene; it includes abortions, children born dead, those who sicken immediately after their birth, and those who cannot live on account of congenital weakness. (Table No. II.)

The distribution is this:

Abortions	321
Born dead before parturition	289
Born dead after parturition	140
Asphyxiated after birth	56
Died of congenital debility	301
	1,107
To which we can add those called statistic inviability which amount to	33
And those who died in consequence of malformation, whose number reaches	9

All these make a total of 1,149 beings snatched from existence before birth or a short time after having seen the light.

Miscarriage may be accidental, but frequently it is a consequence of syphilis in the father or mother, or of diseases of the womb, which might be cured, or of traumatisms which can be avoided. This enumeration is sufficient to make it understood that the bettering of the customs, curing the genital organs of women in good time, the better education and care of health, could reduce that figure considerably.

Children may die after birth by an accidental traumatism but more frequently it is in consequence of congenital syphilis or of diseases of the egg, these being caused by general or local suffering of the womb. This cause of mortality can be diminished by the means of which we have spoken.

Immediately afterwards we have to consider the 301 children who have died of congenital debility, and the 33 of inviability.

The congenital debility is caused by a lack of vigor or strength in the progenitors, by the alteration of the constitution by diathesis or constitutional illnesses; among these are syphilis, anæmia, scrofula, etc. The advanced age of the parents or age prematured by venereal abuses or more specially by the use of alcoholic drinks; in the mothers by depressing moral causes, by the insufficiency of food and uterine diseases. This enumeration will be sufficient to give an idea of what public and private hygiene can do to prevent the premature death of beings just brought into this world.

Those who have died during the travail of child-birth number 140. It is possible that traumatic or moral causes, but which are accidental, represent a figure in this mortality; but what is most probable is that the death of the foetus is brought on by a bad position or presentation in the womb or uterus, by a premature rupture of the amniotic wrapper for lack of timely obstetric operations, such as the version, application of the forceps, and the operation of manual child-birth. These causes could be avoided if pregnant women would suffer a timely examination by a doctor or midwife, when they become convinced that even in what appears to be a most natural confinement they require to be well attended by a doctor or midwife, when the poorer classes, who cannot afford the expense of medical assistance, will resolve to attend consulting rooms and have recourse to the maternity house to be delivered of their children, when finally, the fruit is reaped of the strict application of rules for midwives at present in force. All these reflections can be thus summed up: The mortality of children during child-birth depends principally on the lack of medical assistance at the time, and, as I have already said, attention to public and private hygiene would considerably diminish this mortality.

Analogous considerations can be made in the case of new-born children, who die of asphyxia, which accident generally depends on the want or imperfection of medical assistance.

The table of mortality says that 282 persons have died of chronic alcoholism and 8 of delirum tremens; but this figure, high as it is, does not represent the full number of victims to the abuse of alcoholic bever-

ages or to its long continued use. In effect, we have shown in previous paragraphs that the greater number of cases of cirrhosis which are registered, have been determined by the abuse of alcohol,—that this is the determining cause of many chronic catarrhs of the intestines, causing death, which, however, is not attributed to it in statistics. Many certificates of death mention cerebral congestion, but they do not say that it was directly caused by alcohol; those deaths consequent on alcoholic madness are not referred to as alcholism; many myelites which bring death as their consequence are not put down to alcohol. The atheroma and other injuries of the cardio-vascular organs have been originated by the chronic poisoning of alcohol, but the certificates do not mention this cause. The extent of alcoholism is immense, and appeals to the legislators for the strictest measures; to the public administration, for means to make the acquisition of this spirit difficult; to the societies of temperance and to doctors for the teaching of the great injury and harm caused by alcohol, and for spreading the knowledge of private hygiene, and above all that which tends to teach morality, to the public.

LV.

THE INFECTIOUS DISEASES MOST FREQUENT IN SALTILLO AND THEIR HYGIENIC PROPHYLAXIS.

By Dr. D. GARCIA FUERTES.

Saltillo, at 25° 25′ 15″, north latitude, and 100° 29′ 33″, longitude west from Greenwich, with an elevation above the level of the sea of 1,638 millimetres, is one of those terraces which, rising from the geological depression of the Rio Bravo del Norte, serve as an approach to the Central plateau. The populated portion is on the inclined plane formed by the upheaval, through the volcanic action which took place in that mountain region, of one of those strata of the Tertiary age which form the support of the eastern Sierra Madre. The abundant and vigorous vegetation of these mountains, the elevated valleys (2,000 metres) which they form, and their orientation from north-east to west south-west occasion a copious rainfall there, which by filtration through the permeable coverings causes springs to gush from the Tertiary stratum, forming for the city a moist sub-soil, in spite of the marked declination of the surface (from two to four feet in one hundred). The very considerable slope of the surface allows the rain-water to take a rapid course toward the north, facilitating the detrition of the upper stratum of the soil, while the subsoil retains quite a quantity of the water in its clay-slate strata, which alternate with the calcareous formations and calcareous tophus in the surface of this locality.

The populated portion lying on a hillside, and having as its southern exposure a sloping valley whose limits on the north are mountains relatively low, receives almost constantly a north wind in proportion to the cold and rapid currents produced in the passes and glens of the mountains, which appear to stop abruptly here, giving approach and passage through a little plateau to the upper valley which forms a part of the Central plateau.

Its mean temperature in the last three years has been 16.27° C. in 1889, 17.68° C. in 1890, 16.09° C. in 1891, the mean barometric pressure 32.06, 30.51, and 31.61, the mean relative humidity 66, 63.9, and 61, with very wide variations in determining these averages. These geographical, geological, and meteorological data explain the changeableness of climate. To such an extent is this true that the seasons are irregular and confused, freezing weather having been known in some years in the month of May and agreeable spring temperature in the last days of autumn. It is proverbial among us that no two years are alike.

Saltillo being an old place (founded in 1575) has the defects which all cities built during the colonial period have—streets narrow and crooked, and of very unequal dimensions through which the rain-water runs forming tumultuous currents. Its houses, for the most part built up on low foundations, constructed of poor materials, among which unburnt brick predominates, and built without plan or any architectural style, have also many of those huge interior courts, where the surplus water is emptied, and where the deep and unused wells are situated, which consist of simple pits without timbers or drainage—because the city has no gutters or sewers to collect the overflow from the stoppage of a swollen current, which might be taken over the ground outside and beyond the town. The habitations are paved with bricks which noticeably retain the dampness, its roofs are flat and walls excessively thick ; this prevents them from receiving a sufficient quantity of heat, thus making them pleasant in summer and horribly cold in winter. The water from its numerous springs is slightly charged with calcareous salt, which makes it a little brackish but drinkable, and it waters large innumerable orchards and gardens provided with fruit trees, but this saturation by uniting itself to that from the deep wells tends to add to the dampness of the sub-soil.

In the zone west of this town, and upon the left bank of the stream formed by the rain-water which comes down from the mountains on the south, the vegetation shows greater proportions, becoming almost luxuriant, while on the east is a small brook formed by the dirty water from the public washing-places, tanneries, soap factories, and the washing of wool intended for the manufacture of shoddy. The population of this city is 25,000, scattered over a very extensive area (40 hectares approximately).

I.

INFECTIOUS DISEASES ALMOST ALWAYS DIRECTLY CONTAGIOUS.

These diseases whose germs cannot live or multiply except as parasites of the organism, have their sources of infection and consequently of contagion in the products of the skin and the mucus engendered by micro-organisms which distinguish them, whence they can be scattered to the winds, stick to objects which come in direct contact with the sick man, be deposited in the upper layers of the soil, or diffused in the atmosphere, thus carrying in all directions power of infection and contagion.

These germs will penetrate any part of the system of a healthy person, but it is most probable that the infection takes place in the places where the peculiar characteristics of the diseases appear. Among these diseases exanthematic fevers have taken on in this town all the known forms ; some of them are almost endemic and occasionally become epidemic.

The various forms under which they appear cause us to think that they have a certain connection with the disposition of the individual, with the degrees of immunity natural or acquired, and perhaps with the condition in which the organs of the body are by which infection takes place,

inasmuch as what has been called the spreading power of diseases is only the result of a combination of previous factors; thus it is a fact of frequent observation that one meets with marked differences in the form in which infectious diseases appear in two individuals under similar conditions and attacked at the same time. In one it appears accompanied by alarming symptoms and ends unfavorably, while in the other it runs its course rapidly and without serious consequences. This can depend —supposing in each case the same infectious micro-organism—only on the individual disposition or natural immunity, which in this case will be the greater or less resistance which the skin and the mucus present against the attack and the inherited or acquired vigor of the body as related to the amount of vital energy. Our needy classes are from this point of view not well able to resist, and it is among them that the first cases of almost all infectious diseases appear; and it is among them that we find the greater number of victims.

Its forms depends, first, on the acquired immunity of the organism for resisting the attack of an infectious agent by having once successfully triumphed over the disease, a victory won by the means of a change in the organs where the germs developed, and which perhaps consists in the destruction of certain elements, possibly the weakest, but still necessary to reproduction of the infectious micro-organism. This immunity may be complete and lasting if all these histological elements have been destroyed,—incomplete, if the destruction has been partial, and in this case infection will take place, but in a milder form, modified, and distinguished by different degrees of mildness and the different forms which it takes.

These forms of disease are also influenced by the condition of the parts of the body in which the infection is to take place. And for this reason we see the small-pox attack people of filthy habits, or, perhaps, during extremely cold winters, those who have the functions of the skin inactive and its histological elements in appropriate conditions in consequence to receive the infectious germ. Its tendency to attack the mucus is greater during lactation, and especially when there are gastro-intestinal disturbances, which affect the nutrition of these organs.

Erysipelas also is frequently seen to take on the flictenoid character, when it spreads upon slight scratches in the skin and attacks preferably the hairy skin after sunstrokes. Measles takes on a gastro-intestinal form in people affected by diarrhoea. Scarlet-fever attacks preferably the amigdalas in scrofulous persons, and especially it is an admitted fact, often seen in practice, that infectious intermittent diseases attack preferably the weak parts, modifying the working out of the original affection. The mediation of time and place makes itself felt not in the forms under which infecto-contagious diseases appear, but upon its greater or less frequency because the generative parasites of these diseases are necessary, not optional (i. e., that they can live only for a limited time outside of the system and always require from it for its propagation a proper state of the atmosphere), and topographical and hygienic conditions of

a locality can have no influence beyond the dissemination of these parasites over a more or less extensive area, and in no case in the least important acts of its life such as germination and reproduction.

Among the various epidemics of small-pox, which have been observed in this town, the most important was that of the year 1890, when the mortality was 571 in 25,000 inhabitants; during this year the state of the atmosphere, the quantity of rain, the relative humidity, the direction of the winds, the barometric pressure, and the mean temperature, showed no special or unusual characteristics compared with the meteorological data in other years, and one must suppose that the lack of insufficient supply of vaccine was the cause of this epidemic among us, and we can only attribute to the atmosphere the role of disseminating agent of infectious germs, especially when its relative humidity descends to the minimum, for then we meet with the most appropriate conditions for their easy transmission and dissemination. Thus we explain the fact that the months of May and June, in which the above mentioned meteorological condition relative to the dryness of the air is realized, that the number of cases of small-pox increases here as in most of the towns in the Central plateau.

Scarlet-fever rages with greatest violence in the autumn, a season which in our climate is characterized by excessive variableness of temperature from 26.2 C. to 3.8 C., and the quantity of moisture in the atmosphere from 96 to 32. The prevalence of north winds during this time considerably increases the number of cases. The wind under these circumstances being strong, cold, and damp, is an appropriate medium for making active the micro-organisms which it contains, which in infecting the system will penetrate preferably to the respiratory organs, whose nutrition is disarranged by the extreme change of temperature which precedes and accompanies the north wind. In these same meteorological conditions appear the few cases of diphtheria which I have noted in this town, and I will mention that in the years 1885, '86, '89, in which these diseases were epidemic, a considerable increase was noticed in the amount of rainfall, especially during the months of October and November.

The measles which were almost endemic among us tend to disappear during these later years and the greater number of cases always occurred in the spring. Erysipelas was very frequent in this locality and attacked preferably the hairy parts of the body; it was epidemic in 1890, lasting almost all the year.

Tuberculosis decimated, so to speak, our indigenous race, attacking preferably the respiratory apparatus. This race, a remnant of the Tlaxcaltecas, inhabits the most fertile part of the city. It seems that they have a certain predisposition for contracting this disease, and I believe that it is not the hygienic conditions under which they live which determine entirely the frequency of tuberculosis among them, but rather their insufficient nourishment (fruit, cereals, and vegetables), which by weakening their systems makes the contagion easier and more destructive,

and indirectly insures its transmission by heredity. This disease is also very prevalent among the operatives of the cotton mills. In the greater number of cases it is met with in women in the pulmonary, and in men in the abdominal, form. It may be presumed that the air, vitiated by the particles of cotton and some other extraneous bodies that float constantly in the atmosphere in which these persons live, as well as the high temperature occasioned by friction of the different parts of the machinery, and especially by lack of ventilation, causes constant irritation and inflammation of the respiratory apparatus and keeps the digestive organs in a dyspeptic condition, thus preparing the way for tuberculosis.

Among persons engaged in manufacture of "shoddy," this disease is also prevalent, and with them it is probable that their sedentary life, bad air, and the unsanitary quarter in which they live, which is the coldest and dampest in the town, contribute to its dissemination. Leprosy, which is rather more frequent here than one could wish, appears commonly in the tuberculosis form. Cases of lupus or necrogenic warts are exceptional. It appears leprosy develops every day more and more, to such an extent that in some little settlements situated toward the east there are few families in which there is not or has not been a leper. This is due to the general belief that this disease is not contagious—a belief which is corroborated up to a certain point by the long period of incubation which the bacilli require before the disease breaks out. In these infectious diseases the state of the atmosphere can act only as a generator of epidemics. First, by its temperature modifying its density, and consequently giving rise to currents which aid in the transmission of microbes from one locality to another. Second, by the humidity taking them from the earth or from various objects which contain them, when this degree of humidity reaches the minimum and fixing them on organisms when it reaches the maximum. As a result we should not be surprised that an epidemic of any infectious disease, whatever may be its nature, should appear in some years in the autumn and in others in the spring; that those which we are accustomed to observe during the winter do not happen to appear except in summer; this is the more marked on account of the excessive variableness of our climate. Consequently the part played by the atmosphere is purely passive, and the principal factor in the spreading of these epidemics is the contagion,—that is, the passage of the infectious micro-organism from the sick person to the healthy; and the more direct, the more rapid the transmission of the microbe, the more force it will preserve, and consequently the greater will be its virulence; and the more frequent and easy its approach, the greater will be the number of persons affected.

All the circumstances relating to the place, or what is the same thing, the room, the house, town, or city, will work as factors of contagion. We meet innumerable proofs of the influence exercised by the rooms on the intensity of contagion in the most superficial observation of the facts which constantly crop out in our professional practice. It is unfortunately a firmly rooted custom in our town to shut up the person attacked

by an infectious or contagious disease in the smallest and darkest room in the house, where the air is vitiated, surrounded by objects in the most filthy condition, caused by the saliva from the mouth, urine, foetid matter from ulcers, scabs and exudations. There the disease runs its course, often resulting fatally to the patient and always infecting persons who are about him. In these rooms where the air supply is renewed with difficulty on account of the narrowness or bad arrangement of doors and windows, the air becomes vitiated; and doubly so, on the one hand on account of the fear of the towns-people of the air circulating in the place where the invalid is confined, and on the other hand because of the lack of cleanliness which causes the misery. Moreover in this case the excretions, secretions, and pathological products, coming from the patient, contaminate the air, the floor, the walls, the furniture, from the fact that the pathogenic microbes are apt to lodge on them, and their dissemination in a wider area being impossible on account of the lack of the element in which they swarm, they go on constantly spreading the infection by coming in contact with organisms in favorable conditions to receive them.

We can compare these little rooms which are the refuge of an infected patient, with a new box of Pandora within which are produced and from which proceed all evils. This lack of regard for the laws of health which we meet with in the sick-room, we also find in other parts of the house, not only in the miserable dwellings of the lowest classes, but also in those of the highest classes, where it is true that the rooms are larger but without sufficient ventilation, and where they are, as a rule, dark, cold, and damp, thus contributing not a little to the prejudicial effects of contagion in these cases. The ideas of the poorer people in regard to the confinement of patients extend to these classes of society. The part the city plays in spreading contagion is due to the increased number of inhabitants. This happens only at the periods of civic or religious festivals, when there is an influx of visitors. At these periods I have seen little epidemics of some infectious diseases, which are sufficiently explained by the condition of the houses of the poor. In consequence of the increased numbers one small room will shelter ten or more persons, and if by ill luck there happens to be an infected person among them, the considerable quantity of organic matter given off by the bodies of so many guests becomes a fruitful source of contagion in view of the poor food and exhaustion. But this city by reason of its topographical and hygienic conditions, is not a good medium for the spreading of infecto-contagious diseases. The only thing that tends to aid the contagion is the fact that at times the city is unable to accommodate with ease an extraordinary influx of people.

II.

INFECTIOUS DISEASES INDIRECTLY CONTAGIOUS.

In these diseases the infectious micro-organism is not necessarily a parasite of the body. It may exist as a saprophyte in various nutritive media, to which it comes in a state of embryo, creating in them more hardy and vigorous forms, thus assuring for a longer time the conservation of its species. So long as these infectious germs leave the individual only in the embryonic form their power of contagion does not exist in these conditions, but as the means by which these parasites regain their virility surround the healthy person, he may receive infection from them, and as a result contagion, which in this case will be indirect. The sources of infection of these diseases will then be, not the patient nor his pathological products, but the air, the water, the food, which may have the microbe from the media in which it developed. The variableness of the forms under which these affections may appear is, as in the directly contagious proportionate to the individual idiosyncrasy, acquired immunity, and to the parts of the system through which the parasite penetrates.

In support of this hypothesis we have the notable difference which charcoal presents according to the process which is used to analyze it; thus in the vaccine preserved for this disease and in the cutaneous inoculation made by the contaminated insect of bacillus anthraxis, the accidents produced will have the character of septicemia and the infectious micro-organisms will remain in the system without being eliminated by excretions or accumulated in the sore on the skin, and nearly always will not appear in the decomposed matter of the corpse of the victim; consequently the medium which surrounds it will not be contaminated, for the reason that this infection will not be contagious either directly or indirectly; whereas if the infection is produced by the food which conveys the bacillus, the disease then presents the characteristics of intestinal "carbon" and the pathological products determined by it in the digestive tube will cause the germ to pass into the evacuations, which germinating in the earth in adequate conditions will acquire the power of infection.

The influence which immunity exercises in the manner in which these diseases appear is found in the impunity which anatomical pathological alterations, brought about in the digestive apparatus by the germs which produce them, almost always bring about (for example, necrobiosis of Peyer's patches in typhoid fever) alterations proportional in degree to that of the immunity.

In these infections time and place play a more important part than in the infecto-contagious diseases on account of the greater resistance of the germs, and especially of their faculty of existing outside the system. Abdominal typhus or typhoid fever was in previous years a very common affection in this town, but it is gradually disappearing, only isolated and very rare cases being observed in the lower part of the city. I believe that

the deposits of refuse from the garbage carts, brought to points close to this district, aid in the production of these infections. These deposits receive a great part of the rainfall, and some of them the water from the public washing-places, and when these masses of offal decompose they become an appropriate medium for the cultivation of microbes. Moreover, as they are used as manure in the plantations and tilled lands, besides fertilizing the earth they also deposit infectious germs, which later on are restored in various ways to the organisms which produce them.

But most of the cases of typhoid fever, and the most serious ones, I have observed in those houses in which, owing to the sharp pitch, the water of the well has come to be contaminated by the filtrations from the privy situated in a neighboring building on a higher level. Under these circumstances the infection must have been produced by the water. This indirect contagion became evident from the fact that the persons attacked were not attacked at the same period, and that it ceased as soon as they stopped using contaminated water. Another example of the contaminating action of drinking water in conveying the pathogenic germ of typhoid fever, was met with in the little epidemics of this disease observed on the farms unprovided with springs. In this case the sources of infection are said to have been in the waters of the ponds, which in the months of November and December are at the lowest and in complete decomposition; and as the poor farmers in these places have to use them it is very possible that a person attacked by typhoid fever may have contaminated them by means of his garments, and although this may have taken place long ago these waters will preserve and give greater vigor to the infectious microbes, being a good liquid for their cultivation.

I will mention also an important fact from an etiological point of view in regard to this disease, and it is in relation to annual epidemics of typhoid fever in a little village situated ten leagues west of this city where potatoes are the principal crop. It is a high, dry, and breezy locality, with sufficient drinking water, which is always clear on account of the abundant springs from which it comes. There, in the months from October to December when the crop is gathered, always appear the first cases of this disease; it is to be presumed that the pathogenic microbes have passed from the earth into the potatoes, which are thus converted into a source of infection whose effects make themselves felt at once in a large number of persons. To sum up: Typhoid fever predominates here in localities which are high, dry, and unprovided with springs, taking on the character of an epidemic during the autumn if the rains have not been abundant, or in the winter when October and November have been rainy. These facts seem to confirm the theory of Petenkofer in regard to the drying up of the upper strata of the soil and to the lowering of the level of the waters of the sub-soil. Intestinal "carbon" is entirely unknown, and the cases of anthrax or malignant pustule are exceptional.

III.

DISEASES INFECTIOUS AND NOT CONTAGIOUS.

The fundamental difference between malarial poisoning and the infecto-contagious diseases lies in the fact that the germ which produces the former is a purely scientific parasite, which is disseminated in the ground under certain conditions of heat, dampness, and richness in organic substances, or in water nnder analogous circumstances; but on penetrating into the midst of the organism in the blood it does not meet with the proper means of spreading out and is destroyed. Since there are certain elements of the blood on which the germ of the malaria preferably works, it will not bring about any pathological changes calculated to put it in contact with the outside world for the incessant renewal of its elements, and therefore will not form sources of infection and contagion. The great variety of its forms is subordinated, as in all infectious diseases, to the individual resistance and to the individual predisposition—but here comes in another factor, and that is the greater or less quantities of pathogenic microbes absorbed in proportion to its virulence, and these, varying, are directly subject to the special influence of the *locality*. The strength of the organisms, varying, will cause different degrees of susceptibility to the palustric infection, because the phenomena of resistance to the malarial poisoning being dependent on the action of the microbe on the nervous centres, the existence and duration of each one of those symptoms will be proportionate to the weakness or energy of the nervous system of each individual.

The quantity of microbes absorbed is what most of all would determine the especial way in which the disease would declare itself, because the changes brought about in the individual attacked will always be in direct proportion to the number of microbes—the destroyers of the round globules of the blood. Immunity from malaria cannot exist, and if it does exist it is always incomplete because those elements of the blood on which its action is supposed to operate are constantly changing, and as its alterations do not remain permanent they can not be determined, but on the contrary the organism, weakened more each time by new infections, creates a predisposition to infection.

The location of Saltillo is not one suited for the endemic existence of paludism, because, although its considerable height above sea-level, its medium annual temperature and quantity of rain-fall, would not make it impossible, the lack of ponds or deposits of water rich in nutritive substances, owing to the notable pitch of the underlying base, would be strong reasons for its non-existence among us. We have, however, a short distance toward the north part of the town, localities in which the necessary conditions for engendering it are realized; there the geological strata are in regular layers, the quantity of alluvial soil is considerable, and the quantity of water greater, since, in those localities, the water of our sub-soil which reaches the surface by forming springs, and the impetuous water-

courses which descend from the mountains and elevated parts of that region, unite. This large amount of dampness sets to work here on soft, porous earth, well provided with detritus of animal and vegetable origin, forming swamps, pools, and miry land—suitable media for the malarial germ. Our population by its topographical situation is located between two distinct and well marked zones. The estates and villages situated toward the south, in the valleys and glades which form the mountains, with an elevation above sea-level of 1,600 to 2,100 metres, form the first zone, where malarial poisoning is very rare. The north region is the second zone; there the declinations are very abrupt, passing from 1,600 to 800 metres above sea-level in a relatively short distance (15 to 25 leagues); here malarial poisoning exists in all its forms.

Saltillo forms, so to speak, a bond of union between these two zones and consequently the peculiarities of the malaria, which, influenced by the change of location, begins to yield to it. The intermittent fevers of the daily type are most rare, and we only encounter them in those individuals who have received the infection in the most northerly points of the north zone, or perhaps in the frontier villages of our state, or of the neighborhood of Neuvo Leon. These people thus referred to would not show outwardly anything that would indicate them to be attacked by paludism, and only after remaining here twelve, twenty-four, or forty-eight hours does the disease declare itself, taking the typical hot and cold initial form, etc.

This same peculiarity presents itself in those people who buy a considerable quantity of fruit and other products from the malarial region mentioned; in this case the malarial microbe has passed from the earth to the plants which produce these fruits (watermelons, oranges, and sugar-cane), which reach our market in the months from July to October, when the amount of rain-fall, and consequently the assimilation in the plants of the matter absorbed from the earth, reaches its maximum.

We have, then, other series of signs of paludism during the autumn and part of the winter, and it is manifested by what we might call the anomalous forms, those in which the true nature of the affection masks itself with misleading symptoms or phenomena which appear to be due to entirely different ailments. These anomalous forms are, the larval fevers of Tartenson, and (among those which we have frequently) neuralgia in its several forms, sciatica, etc., whose relation to malarial poisoning we cannot discern, unless by its way of yielding to quinine, although neither the elevation of temperature nor the intermittent aspect is clearly presented.

I believe I ought to put in this category various spasmodic phenomena such as convulsive cough, loss of speech, and paralysis of the eye muscles, which are met with in conditions similar to the former in the point of view of its short duration and its curability by anti-periodic medicines. In these last months we have called attention to various cases of cerebral excitement, apparently serious, accompanied by a notable fall of temperature (35° to 36°) in people who, to ascertain its relation to malarial

poisoning, have had a bacteriological examination of the blood, finding in it the semilunar bodies of Laveran.

Among the dangerous forms of these larval fevers we have the pneumonic, or malarial pneumonia, in which the high temperature (from 39½° to 40½°) which the thermometer reaches in the first days of the sickness, its rapid evolution (5 to 8 days), its form almost always lobullar, make us believe it has a malarial origin,—above all when its more or less marked changes are noted. We observe this affection from February to May, and if the cold spells, so frequent in those months, have any influence in its spreading it will not pretend to be more than a tendency to fix in the respiratory passages the action of malarial poisoning, diminishing the resistance of those organs by the disturbance of its circulation and nutrition.

The larval typhoid fever, a continuous paludic fever, malarial typhus, known among us by the name of remittent fever, is the disease most frequent in that locality during the summer and autumn. It comes accompanied, after the first days of high temperature (39½° to 40°), by disorders of the brain and alimentary canal. These are extremely variable and disappear promptly, the fever alone remaining, with very marked changes from 38½° to 40° and in rare cases the cerebral symptoms but little lessened. It rarely exceeds 14 days in duration. As exceptional cases I will mention those in which the abdominal symptoms predominate so much that the affection is liable to be mistaken, especially in its early stages, for gastric obstruction. But the upheavals produced by this self-intoxication disappear promptly, leaving the remittent fever which begins to yield to the quinine.

In all the manifestations of paludism observed here it has one important action determining its form and seriousness. The special topographical situation protects this town in regard to the malarial zone from which it receives, with the prevailing north winds, variable quantities of microbes, sometimes weakened in their flight, some of which will aid in establishing incomplete infections mingling many times their own action with that of other germs, and generating, when the supply is short, the mild larvae in one part or another of the nervous system of the person affected. It will determine the form, while the serious result will be occasioned by a larger quantity of microbes,—or, perhaps, even the quantity might be small when they work upon weakened organisms; thus I have seen, frequently, these last forms spread after extreme chills such as those produced by a hot and prolonged bath.

IV.

RHEUMATIC DISEASES (PROBABLY INFECTIOUS).

The analogy of rheumatism with malaria is notable in the fever, the non-elimination of the pathogenic agent and its non-contagious character, the uncertainty of its progress and duration, and the ease with which the attacks are repeated (or lack of protection). If to these characteristics we add the analogous conditions of spreading, a damp, low climate and fixed meteorological conditions for the exercise of its action, we will show a combination of factors sufficient for classing, with Maclagan, rheumatism among the diseases infectious and not contagious, although the micro-organism which engenders it has not yet been discovered. The only noticeable differences or discrepancies between rheumatism and these diseases are the following: The large quantity of fibrine and lactic acid in the blood of rheumatic people, its limitation to certain ages, and its hereditary tendency. But these differences are not fundamental nor characteristic, since the increase of fibrine may be encountered in any infectious disease, or not,—always in those which produce inflammation and in those in which the disintegration of parts affected causes a change of the elements; the lactic acid can be formed by similar action at the expense of the glucose of the muscles. The fact of its not attacking children and old people, is due to the peculiar conditions of the fibrous and serous textures in those ages. In the child it has not sufficient strength, there is not in them energy to do the work, and it is probable that the necessary elements are there lacking for the needs of the micro-organism which seeks here its favorable agent, which is the culture-liquid or the proper medium for its spread. In old people those conditions of the fibrous and serous textures indispensable for the spreading of the rheumatism have disappeared. In regard to its hereditary transmission, we have tuberculosis and leprosy which are met with under similar conditions, and therefore this would not be an exception to it.

In rheumatism, as in infectious diseases, the individual disposition plays an important part in the determination of the form which the disease takes on, and here it has a greater importance from the fact of its being hereditary; those who have rheumatic ancestors will be more likely to contract it, from having inherited from them a certain lack of strength in those parts where the microbe preferably spreads. Age, sex, profession, and manner of living have a share in producing the disease, by virtue of the influence they can exercise upon the chills which facilitate the rheumatic infection.

But the topographical and climatological conditions of the locality will become the most important as generators of rheumatism and its different modifications. The conditions of our sub-soil are such that it is well fitted to act as a generator of rheumatism; so the winter, when the absolute quantity of water reaches its maximum and it is noticeably rainy, is the time when the greater number of cases present themselves.

The forms which are most frequent among the farmers are those in which they have chills in the early hours of the morning. Among the rheumatic affections of the locomotor apparatus, the articular acute and sub-acute, the mialgia, the arthritis, are very frequent. Among those of the vasculo-motor apparatus, endocarditis and pericarditis appear simultaneously with the former, or even alone, giving us the explanation of so large a number of sudden deaths in this town. Among the anamolous forms of rheumatism, the rheumatic quinsy, the dance, and the sciatica present themselves to us very frequently in our practice, and we believe that they have a certain relation to rheumatism from the fact that they yield to the same kind of treatment. It is difficult to describe the connection this disease has with rheumatic poliarthritis, the geniculations of Heberden, the localized rheumatoid arthritis, and the combination of symptoms which form what we call chronic articular rheumatism; and it is fair to presume that its bonds of union with true rheumatism would be only what an individual with rheumatism retains, with certain alterations, in the fibrous and serous textures,—it is they that give it a tendency to acquire here new inflammation by more or less severe chills. I do not believe that these affections ought to form a part of the statistics of rheumatic patients, because they neither produce the same changes nor are they curable by the same treatment.

V.

HYGIENIC PROPHYLAXIS OF INFECTIOUS DISEASES.

While it is not in our power to prevent the formation of the generating microbes of these diseases, we ought to devote ourselves to finding out the best means of preventing their reproduction, diminishing as much as possible their quantity, and to opposing their action upon the organism, by giving to it the means and strength necessary to resist them or fight hopefully against being attacked by them.

Contagion being the principal means by which the generating microbes of the infecto-contagious diseases multiply, our efforts ought to be directed toward preventing and limiting it. In the exanthematic fevers we can do much in this line, by virtue of which its pathogenic germs, situated in more direct contact with the outside world, can be destroyed more readily, and warn us of the danger. Therefore, let us always isolate the first person attacked by one of these infectious diseases, and prevent him from coming in contact with more people than are necessary for his care and help. But this isolation, this seclusion, ought to be complete and strict, so that it is necessary that boards of health, and authorities of similar power, order and regulate by law measures having that object in view, and thus we shall have succeeded in preventing a person afflicted with these infecto-contagious diseases becoming a focus of contagion. It is indispensable that in these regulations two fundamental rules should be emphasized,—first, that relative to the absolute prohibition of coming

in contact with the patient; second, that concerning the absolute disinfection of the room, and of objects soiled by the patient.

In case of tuberculosis, it might be necessary to inform the persons who are ill, and their families, of the contagious character of the disease, which is often not known, for if it is the popular belief that the contagion demands an innumerable number of special circumstances for its reproduction, the danger is thereby increased, above all, when the disease is always deadly.

This information ought to be accompanied by necessary directions for the use of proper substances to destroy the pathogenic microbe in the sputa. In case of cutaneous tuberculosis, although less serious, it is indispensable to advise that direct contact with the parts affected be avoided, and that scrupulous cleanliness prevail in those in attendance. Leprosy, a horribly repugnant disease, whose dissemination, although slow, always terminates unfavorably, calls for energetic measures to fight it; it is not necessary to go back some centuries for the energy of the prophylactic means, but it is indispensable to check its always increasing progress. Isolating all those stricken with leprosy not now in lazarettos, would be impossible in view of the moderation and tolerance of our customs; but if we could select definitely prescribed localities for them to live in, chosen places where they could find all the means of subsistence, the sea would make a permanent barrier, and prevent them from coming in contact with healthy people. This would seem extremely hard, were it not that the contagious power of this disease manifests itself in the air, food, and water; but thus we would escape, always, direct contact, which is undoubtedly the most important factor in the transmission of the disease, and above all, we limit in this way its propagation by heredity.

The action of prophylactic hygiene is more important when it concerns itself with those affections in which the germ which produces them possesses greater resistance, and hence has its infectious action prolonged for a greater length of time. In typhoid fever our attention ought to be directed to preventing the germs which generate it from recovering their strength, and from spreading. To this end are all the regulations of the police and sanitary hygiene, relative to the cleanliness of the cities and the prohibition of the accumulations of rubbish about the houses which could enter into decomposition.

But we shall not have succeeded at all, or very little, with these measures, unless we destroy at their birth the germs in the evacuations of persons afflicted with this disease; it is indispensable to prevent them from reaching the earth, which might contaminate the drinking water; so that it is necessary to disinfect the linen, and other objects soiled by the evacuations, and at such a time it would be better to destroy them by fire, for the most powerful antiseptics might by their imperfect application, or slow action, not accomplish the desired end.

Contaminated water being the principal agent in the propagation of this disease, and having acquired its infectious power from the filtrations of the dejections, it would be convenient—or to speak more truly, indis-

pensable,—if we wish to have typhoid fever disappear from our midst, that they be fenced off, as also the wells which receive their filtrations.

Besides this measure, we should establish a strict regulation against washing, at the public washing-places, clothes which come from a house where this infectious disease is suspected of existing, for the lack of care relative to the disinfection and destruction of soiled objects may cause them to form foci of infection in the places where the water is which has been employed for the washing of these objects, and to scatter themselves abroad. This is an argument in favor of the complete and perfect piping of the water which the town uses.

In regard to the proper means for escaping the action of malarial poisoning, whose effects are felt constantly among us, perhaps it would be convenient to form, toward the north part of the town, groves of poplars, which, by absorbing the malarial microbes, might prevent their arrival, and hence their infectious action. But where we ought to direct our attention, if we are resolved on diminishing its quantity, is to the measures most adapted to the prevention of the formation of the ponds of the northern paludic zone, which might be accomplished by assisting the approach, to the cultivated land, of water which runs through the streets of the town; by facilitating the distribution of spring and rain water, preventing them from forming deposits in the porous soil, rich in vegetation; and, above all, by regulating the distribution of the wages of labor on the water-works in the villages of that zone, obliging the proprietors of those privileges to construct trenches adequate to prevent the water from forming marshes, reservoirs in which the refuse of the houses, excrement of the domestic animals, etc., cause the formation of a medium well adapted to the dissemination of the malarial germ. To give the organism the energy necessary to resist the action of the infectious germs, we ought to give it impunity or invulnerability, and this we will not be able to do unless we acquire ample strength for resisting the attack of these germs. The methods we may employ for this object are as follows: To neutralize it in the contest by means of vaccine made of adulterated microbes whose poisonous properties have been very much weakened, so that it is not unsafe. Vaccination should be the means employed, and as in small-pox, we should accomplish its complete success; but we are obliged to keep it up from the moment we depend upon its efficiency. But to do this it is necessary—taking into consideration the ignorance of our people, and the open opposition which they entertain toward this prophylactic measure—to make it obligatory, and threaten with severe penalties a failure to do it; for as our laws can compel the father of a family to see that his children are instructed and educated, with equal justice they might make them receive this preventive inoculation which would give them one more guaranty of life; but it is necessary that it should be done at home with all necessary aseptic precautions, and that a strict watch should be kept over the vaccinated until it is certain that the operation is successful.

From the prophylactic point of view we ought to take care that this

inoculation be made from soluble substances made from the infectious micro-organisms in the economy, whether it be with the same ones weakened by contact with distinct organisms or with analagous microbes, so that always in all cases the immunity may be obtained without danger.

The ceaseless progress of science may tend to give us some day the vaccine for the other infecto-contagious diseases, but while it is not yet possible to give to the person this immunity acquired by measures of vaccination, it is our duty to point out what are the best means of maintaining or producing natural immunity; this varies for each disease in the same organism, and is likewise distinct in the different races, in the different communities formed by the same race, in relation to climate, food, and method of life of their founders. But in general terms we might say that all the measures dictated by public and private hygiene for the preservation of health are only those which tend to invest the economy with the necessary energy to resist being attacked by the deadly germs of the infectious and infecto-contagious diseases. You will find at least that there is a strong probability that you will not serve as a nutritive medium for these germs, and you will fight strongly against being attacked by them.

LVI.

SANITARY TREATMENT OF GARBAGE AND INFECTED MATERIALS BY THE "SIMONIN PROCESS."

By I. M. SIMONIN, Civil Engineer,

Philadelphia, Pa.

Mr. President and Gentlemen: To be permitted to address this learned and honorable body is an honor that any man may well be proud of, and I would indeed be unmindful and ungrateful did I not most thoroughly appreciate this evidence of your confidence; therefore, permit me to thank you most sincerely for this mark of distinction.

New England, the acknowledged leader in art and culture, also stands out prominently as the one central figure in the sanitary arena, and the other states in the Union, before approving of it, and previous to adopting any hygenic measure, will almost invariably demand that the proposed improvement bear upon it the stamp of approbation of the New England health authorities.

I am here to-day to speak to you briefly of the process now in use in the city of Providence, R. I., for the sanitary disposition of kitchen refuse and the disinfection of infected materials. No question of municipal government plays a more important role, or occupies a more prominent position upon the desk of the health officer, than does the problem: "What shall we do with our refuse?"

It is the vital, the living, the all-important, question which to-day confronts the sanitary authority, and causes him to pass sleepless nights.

The system, or process if you will, first introduced at Providence, is the invention of my father, Mr. C. F. Simonin, in the year 1869. Though his process was, and is to-day, recognized as a thoroughly sanitary one, it was not brought to public attention as a means of disposing of vegetable refuse, for the reason that it could not be operated for that purpose except at a large financial loss. It is known as the naptha vapor process, and has been in use for more than twenty years as a method of treating animal refuse and other material known to contain an excess of grease.

This was fully explained to the company, composed of public-spirited citizens of Providence, who proposed, in conjunction with the health officer, Dr. Chapin, of that city, to introduce this system; but they, recognizing the evil of the means at that time used for disposing of this material, were willing to introduce this process, which their health officer considered the only sanitary one then in existence, stating, that if

it was not a commercial success, they could demonstrate the amount of financial assistance necessary to be obtained from cities in order to make it so. The Providence works were started about April, 1890, and the eight months they were run by this company fully demonstrated that the process, while a sanitary one, could not be worked without considerable loss. Having conceived a number of ideas, the introduction of which we knew would not only improve the process from a sanitary point, but also reduce the expenses, I leased this plant and introduced the process, covered by letters patent, granted January 5, 1892, to J. M. & C. F. Simonin. It has been fully demonstrated in the time (two years) it has been under my control, that it is not only practicable to introduce this process in large cities, but in any location that will deliver daily five tons of this refuse material; and we are prepared to build such works, if favorable contracts can be had, at a price much below that for which the same can be cremated or treated by any other process.

The refuse material received at Providence, without removing any of the tins, bottles, rags, etc., which necessarily are mixed in large quantities with garbage, is placed on iron cars, which are inclosed in an iron tank called an "extractor," and it is there subjected for about twenty-four hours to hot naphtha baths. The first application of naphtha destroys all germ life present, and precipitates most of the water that is mechanically mixed with the garbage. A number of applications thoroughly dry the material and free it of present grease and oil. The mode of receiving garbage at Providence is not only primitive, but unsatisfactory to me, but these being the first works built, and having no knowledge of the objections likely to result by exposing a mass of this material, no provisions were made at these works for properly receiving the garbage. As the material by this process is not assorted when received, and as it is the only utilizing process of which this can be said, all of it being placed at once in the extractor, it is possible for any good mechanic to devise an air-tight pocket that will receive this material as soon as delivered at the works, and from these pockets it can be placed into the extractor without so much as offending the sense of sight. If the tins, rags, etc., must be removed from the garbage, which is the case where it goes into a "dryer," it ceases to be a sanitary measure, these offensive materials being harbingers for the spreading of disease in many households. From the commercial point, the works at Providence are poorly located, long hauling being necessary on all coal delivered and all products shipped, and under the present contract, which has but a short time to run, it will not pay to put these costly improvements in at these works; but at the plant now being constructed at Cincinnati, all necessary improvements for the receiving of garbage are being introduced. The improvements for the receipt of this crude material must be introduced by all systems, and to this point, all processes, if the material is not assorted before going into the pockets, are similar, and it is from this time, after the garbage is received from the pockets, all systems must be joined.

It has been asserted that, to operate this process, there is danger from fire. In answer to that assertion, I will say that for over a period of twenty years in Philadelphia we have worked a naptha vapor process, and in that time have never had a fire or an accident.

I would state that an insurance at a low premium is carried on all the buildings and machinery at Providence, and a casualty insurance on both the workmen employed there, and the public, is carried, and is classified in the least dangerous class: this fact sufficiently proves its safety.

The different kinds of animal and vegetable refuse treated retain their original shape; consequently, we claim it is applicable by this process to treat, not only animal refuse, but all dead bodies; and by varying the process slightly we can treat the dead, so that while the disease germ is killed it is done without any injury to the body.

The material is taken from the extractor and ground, and finds a ready sale as a fertilizer. A quantity has been sent to Germany, and it is there being experimented with as an animal food. It is pure, and far more so, than the food as it comes originally to our tables. It has been proved that the meat you eat, the milk you drink, etc., are tainted with many diseased germs. This process not only destroys these, but the resulting product, being free from moisture and grease, ceases to be fertile ground for the growth of any germs.

The serious obstacle to the introduction of this process and all other sanitary measures, is a lack of power delegated to cities to make contracts for sufficient length of time. If introduced into cities where contracts can be given only for a short period, the charges must be excessive, in order to protect the capitalist in case contracts should not be renewed. To obtain the cheapest return, the city should not only have power to make a long contract, but also have power to build its own plant.

At Cincinnati, our company made two bids: the first bid was fifty per cent. lower than any of our competitors, it equalling forty-two cents a ton and we supplying our own apparatus. The second proposition made by us was to build and erect a complete plant for the city, at the city's expense, and we then to manage the plant, and consume the garbage of the city, paying the city about ten cents a ton on all garbage delivered, bonds being tendered in sufficient amount to secure the city.

The second proposition, which saved the city over our first proposition about $250,000, was decided by her solicitor to be illegal, as it required special enactment of the legislature to make such a purchase.

This process is the only system that is applicable as a sterilizer, by which all infected material can be treated without being injured; and most materials treated are improved; bedding, clothing, drapery, carpets, furniture, etc., are by this process made moth-proof. Many materials, such as leather, and glued furniture, which are destroyed by hot-air or steam sterilizers, can be effectively treated by this process without injury.

If this system was in operation at every seaport town, we would be fully

equipped to fight infections likely to be brought to us from foreign shores, and not be, as we are, unprepared to meet the dangers that threaten us at the present time. Most of us have read the recommendation of Surgeon-General Wyman, that a sterilizer be placed at Ellis Island, New York, so as to be prepared to disinfect cargoes from ports infected by cholera. Does not the same danger threaten us at all seaports? It is a fact fully established, that epidemics start from the carelessness exhibited in places where we least expect, and which are poorly prepared to combat a disease; for when once an epidemic obtains a foothold, it must run its course.

Permit me, in conclusion, to state that the enlightenment of the present age, and the rapid strides being daily made, indicate that destruction should not be encouraged or advocated by sanitarians, and particularly as in this case, with products so valuable as your kitchen waste.

The demand for both animal and plant food is increasing every year, while the sources of supply do not increase in the same ratio. It is the duty of scientists to supply this want, by not only saving that which we now waste, but by constantly striving to increase the avenues of supply.

Far be it then, that this learned body, or any member of it, indorse the introduction of these instruments of destruction.

I take this opportunity, Mr. President, to acknowledge the valued services of one of your members, Dr. Chapin, of Providence, in fostering this industry in its infancy. We are indebted to him for much valued services and advice. You, who have had the benefit of his advice in your deliberations, know better than I do his just merit and the unselfishness with which he gives his time and talents to matters that may be of benefit to the public.

I also desire to express my appreciation of the work done in this cause by a noted sanitarian in the West, Dr. Prendergast, of Cincinnati. It is to him, and to his able assistants in his department, that we are able to demonstrate the efficient and quick action of hydrocarbon, the re-agent used in this process on the destruction of germ life.

REPORT OF STANDING COMMITTEE ON NATIONAL HEALTH LEGISLATION.

To the American Public Health Association:

Your Committee on National Legislation respectfully reports that it has given to this subject careful and long-continued study and discussion, and now offers a brief outline of its conclusions with respect to the public service of the United States.

It is well known to this Association, that while many of the states in the United States and provinces in Canada have excellent state and provincial boards of health, and the Republic of Mexico has a well-organized federal board of health, the United States federal government has, as yet, no public health service worthy of such a great country. Only a few of the several divisions of work which should be performed by a great nation for the safety of life and health among its people have been provided for. Its public health service should include several divisions, such as,—

1. For the collection and compilation of mortality statistics, sickness statistics and meteorological statistics, and for the utilization of all such statistics in gaining accurate knowledge of the causes of mortality, the causes of diseases, and the progress made from time to time in the prevention of each important disease through the measures adopted.

2. For bacteriological and other laboratory investigations, such as those to learn methods for the production of immunity, and into the causes of diseases of mankind, similar to those which have already been so successfully made by the United States government into the causes of diseases of animals and plants, and such as have been legally provided for by the Republic of Mexico, relative to the diseases of man, and such as have yielded such brilliant and valuable results in Germany through the laboratory work of Professor Koch, in France by the work of Pasteur, and in England by the local (General) government board.

3. For a system of inter-state aid in protection from the spread of dangerous diseases, which system shall be based upon the well known principles of sanitary science, being a system of inspection, isolation of infected persons and things, and final disinfection.

4. For a national quarantine service, which shall do what no local quarantine can do so well,—utilize the information obtained in every foreign country by the United States diplomatic and consular service, utilize the knowledge gained by all the several divisions of the national health service, and systematize the quarantine service, so that instead of being, as now, exceedingly weak and inefficient in many places, it shall be uniformly effective.

The national public health service should be organized under a responsible head, into a bureau, or a department, of public health, with divisions such as have been named; and each division should have for its chief officer an expert in that special branch of sanitation. The chief sanitary officer of the government should be chosen by a commission of sanitary experts, and should not be subject to removal so long as he faithfully and properly discharges his duties. He should annually submit to the head of said department, or to the president of the United States, for transmission to congress, estimates for the expenses necessary to sustain properly the health department during the ensuing year. His duties, however, as the chief sanitary officer of a great nation, need not be here specified. Such a permanent national commission of sanitarians, as has been referred to, should be provided for by congress, and should not consist of *ex-officio* members, but of the leading sanitarians of the country, appointed because of their experience in practical sanitary work.

Your committee believes, also, that it will be well for the United States government to provide for the organized assistance of the health departments of the several states, by authorizing the president to call a meeting in Washington, of delegates, one from each state board of health, once in each year, or whenever general coöperation or conference is deemed advisable.

H. P. Walcott, *Chairman*,
J. D. Plunket,
Irving A. Watson,
Henry B. Baker.

City of Mexico, Nov. 30, 1892.

REPORT OF THE COMMITTEE ON THE DISPOSAL OF WASTE AND GARBAGE.

The Committee on the Disposal of Garbage desires briefly to state that they have been studying the question during the year, but are not ready as yet to make a final report. New methods of disposal are being brought into use, and existing methods greatly improved. In consequence of the agitation of this subject by this committee, and by this Association, it is evident that improvements will continue to be made.

Last year we brought to the notice of the Association, three methods of disposal which have had extensive trials in different parts of the country. Accompanying this, is a paper descriptive of the Simonin process now in use in the cities of Providence and Cincinnati. It is presented here for the information of any interested in this question.

The Committee does not feel that any one method at the present time can be advocated to the exclusion of all others, for they all have merits and defects. The final report of this Committee should embody the results of the examination of the different methods, these examinations made through its individual members or their authorized agents, the descriptions embracing statements both as to efficiency and cost.

Respectfully submitted:

DELOS FALL, *Chairman.*

Albion, Mich., Nov. 14, 1892.

REPORT OF THE COMMITTEE ON SANITARY AND MEDICAL SERVICE ON EMIGRANT SHIPS.

In the report of your committee in 1890, the subject of sanitary and medical service on emigrant ships was treated somewhat in detail.

The additional observations of the committee for the last two years, are but confirmatory of its previous experiences with emigrant ships, and do not call for an extended report at this time. Your committee therefore beg to emphasize, with brief mention, portions of the report of 1890, and call attention to the importance of immediate sanitary legislation in behalf of emigrant passengers and seamen, and for the protection of America against the importation of communicable diseases.

As a result of our observations since the last report, we have to state that no noticeable improvement has been made in the construction of emigrant ships, or in the sanitary and medical service thereon. The space allowed between decks for each person is too small by at least 100 per cent. The light which can by any possibility enter these compartments and spaces in many ships is insufficient for the health of the occupant, or even to betray the presence of the heaps of filth which are deposited on the floors. The means prescribed by law for the ventilation of the ships and the supply of fresh air in suitable quantity, and of proper transportation for passengers, are poor in principle and wholly unsuccessful in use.

The necessary cleanliness of person, bedding, floors, latrines, and lavatories, is not generally enforced, and no suitable officer is charged with that duty. The hospitals are inadequately provided with means for ventilation, and are so badly located—between decks, and on passageways which are in common use—that the isolation of contagious diseases in them is practically impossible. The medical inspection of passengers is not sufficiently frequent and skilful to prevent the frequent spread of contagious diseases from the first person affected, to others.

The legitimate result of this overcrowded, ill ventilated, un-cleanly, and unwatched condition of the ship is, the frequent spread of dangerous diseases among the passengers, without the proper means for the care, isolation of the patients on board, and the frequent need for serious quarantine detention at ports of entry, and hardships to those who should not have been exposed to the disease. Even when the more serious results from contagious diseases do not obtain, the ill effects of such enforced confinement of persons, under the conditions referred to, for ten to fifteen days on shipboard, have been recently observed by our quarantine physicians, by whom the first inspections are made.

These strangers, soon after landing, are seen at our free dispensaries

for medical advice, where the physician finds skin disease and other affections, which, we are told by good authority, are induced by the condition of their sea voyage and are peculiar to the emigrant. We next find these people in our hospitals, alms-houses, and prisons, where four fifths of the inmates are shown to be foreign born.

Much of the cause of this unwelcome civil state, and many of the expensive and serious quarantine requirements, may be laid at the door of steamship companies, whose agents are scattered throughout Europe, soliciting patronage for their companies through emigration at the cheapest rates. So long as the laws concerning emigrant ships and emigration remain unchanged on our statute-books, and steamship companies can make money by packing their vessels with the poorest and dirtiest population of Europe, and landing them on our shores at fifteen to twenty-five dollars per head, so long shall we need to be solicitous, not only for our own quarantine service, but for the general health and civil condition of our country.

Your committee therefore deems it most fitting that the American Public Health Association, representing as it does the administration of quarantine and public medicine in America, should thus give expression to its views on this subject, and that the governments of the United States, Canada, and Mexico be memorialized to enact such changes in our emigration laws as shall better provide for the welfare of passengers and seamen on shipboard, and for the protection of the several countries against the importation of dangerous diseases.

Respectfully submitted:

S. H. Durgin,
Albert L. Gihon,
F. Montizambert,
Walter Wyman,
} *Committee.*

PROCEEDINGS AND DISCUSSIONS OF THE TWENTIETH ANNUAL MEETING

HELD IN

THE CITY OF MEXICO, MEXICO, NOVEMBER 29, 30, DECEMBER 1, 2, 3, 1892.

TUESDAY, November 29, 1892.

MORNING SESSION.—9 O'CLOCK.

The twentieth annual session of the American Public Health Association was called to order in the chamber of deputies at 9 o'clock a. m., by the President, Dr. Felix Formento.

THE PRESIDENT.—I am sure we all feel great satisfaction and pleasure on receiving so cordial a welcome to the City of Mexico, and we have to congratulate ourselves upon this most auspicious opening of the twentieth annual meeting of our Association. Seventy-four papers have been written for presentation at this meeting, only a few of which can be read, but I trust these may be very fully discussed. This meeting promises to be the grandest in the history of the Association. We have already received 500 new applications for membership.

Rev. Mr. Buck will say a few words of prayer.

THE PRESIDENT.—Dr. Licéaga, chairman of the local Committee for Arrangements, will make the announcement for that committee.

DR. LICÉAGA.—I have the greatest pleasure in greeting the members of this Association and in welcoming them to this city. Our President has informed me that, in accordance with the practices of this Association, I am expected to report to you all that has been done and that is proposed to be done with respect to this meeting.

With respect to the reception of those persons who have honored us with their presence in this capital, committees were named to receive the members of the Association coming from Canada and the United States, because, as we were informed, they were coming in a body. These commissions were appointed with the object of facilitating matters on the arrival of the trains and of guiding the foreign members to the hotels in which they would be lodged.

This programme has been carried out as far as was possible, and everything has been done that could be thought of for the comfort and pleasure of our visiting members. At the same time we have informed them all, that if the lodgings in which they have been placed were not

according to their tastes or to their requirements, they should only stop for that one morning, and something more to their taste would be procured for them.

We hope, therefore, that the mistakes which may have been made by the local committee will be overlooked, in view of the good will and zeal with which they have fulfilled their commission.

With respect to the programme, although you already know it, I have, nevertheless, to inform you what the plans are for to-day. Once the session is over we have a certain time disposable, which was appropriated to a visit to the School of Arts and Trades for Men; but some indispensable and urgent repairs in the building render this visit impossible, and I therefore beg the members of the Association to meet in the Hotel Iturbide at 2 o'clock in the afternoon, when Dr. Juan Jose Ramirez de Arellaño will conduct them to the Preparatory School. There will be time for the members to inspect this important establishment before commencing our ordinary session, which will be held in that same school from 3 to 5 o'clock in the afternoon, as indicated in the programme for the day's work.

On leaving the Preparatory School, the same Dr. Ramirez de Arellaño will conduct the members of the Association to the National Observatory, where everything is prepared for their reception. After that there will be a period of rest before we meet at 8 o'clock in the National Theatre.

According to the programme, that meeting ought to be held in this same hall; but as you yourselves can see, this hall is not large enough to contain all the members of the Association, so that it would not be large enough for the members in full meeting, and still less would there be room for the families of the high officers of state, of the diplomatic corps, and other distinguished persons whom we expect to honor us with their presence.

For this reason the place of the meeting has been altered, and it will take place in the National Theatre at 8 o'clock this evening, in accordance with the programme that will there be distributed. The members of the Association do not require any tickets to enter with; the badge which they carry will be quite enough, but if they desire to make any arrangements with reference to seats, they can do so in the Hotel Iturbide, where tickets will be distributed.

This is the programme for to-day.

THE PRESIDENT.—We will now listen to the report of the Executive Committee.

THE SECRETARY.—There is no special report from the Executive Committee at this time, except the presentation of the applications for membership, which have been duly approved, examined, and recommended by the Executive Committee. There are 548 applications for membership at this time; 189 outside the Federal District of Mexico, 141 from the Federal District, and 218 from the United States and Canada. Inasmuch as it will consume much time to read these names,

I move that the President be authorized to cast the ballot of the Association for their election.

DR. GIHON.—Mr. President, I move that the Secretary be authorized to cast the ballot of the Association for the election of the new members.

(Motion seconded and carried.)

THE SECRETARY.—In accordance with the motion I cast the ballot in my hand as the vote of the Association for the election of the new members.

THE PRESIDENT.—I move that President Porfirio Diaz be elected an honorary member of this Association.

(Motion seconded and carried.)

THE PRESIDENT.—The first paper to be presented this morning is by Dr. R. C. Kedzie, of Lansing, Mich., on "The Ground of Safety." (See page 27.)

Dr. Kedzie not being present, Dr. Antonio J. Carbajal, of the Federal District, will present a paper on "Influence of Climate on the Progress and Severity of Pulmonary Tuberculosis in the United States of Mexico." (See page 43.)

(Translation distributed among the audience.)

THE PRESIDENT.—There being no discussion on this paper, we will proceed to "General Considerations on the Importance of Public Hygiene," by Dr. Rafael Lavista, Federal District of Mexico. (See page 55.)

Paper on "Medical Demography," by Dr. W. A. Haskell, of Alton, Ill. (See page 111.)

(Dr. Haskell not being present, the paper was read by Medical Director Albert L. Gihon.)

THE PRESIDENT.—The next paper to be presented is on the "Climate of the City of Mexico," by Dr. Domingo Orvañanos, Mexico. (See page 367.)

DR. OTERO.—I have asked for the floor in the first place to congratulate Drs. Carbajal and Orvañanos on their conscientious work, and in the second place to submit an opinion which has been suggested to me by the papers of both gentlemen.

Dr. Orvañanos has spoken of the climate of the capital in the abstract, and Dr. Carbajal has spoken of the curability of consumption,—or rather, of the influence of climate on tuberculosis. Well, after hearing, with the greatest of pleasure, the paper read by Dr. Orvañanos, it seems to me very desirable that similar studies should be carried out in all the towns throughout the central tableland, where the climate has also been found beneficial to consumptive patients, because, as I well remember, Jaccond, in that magnificent work which he has written under the title of "The Curability of Phthisis," does not understand as an elevated climate that which is at a great elevation above the sea level. An elevated climate, he says, is that which is situated at a certain altitude above the sea level; but it also requires other conditions, such as mild winters and summers that he calls relatively cold, little humidity in the atmosphere,

and an absence of sudden changes in the temperature, with an almost total absence of winds.

Therefore, if these are the conditions of an elevated climate, it is clearly evident that the mere fact of some of them being found in places of the central table-land does not at once determine them as good points for consumptive patients, because it may very well happen that some or the greater part of the conditions which I have already pointed out may be wanting in those places although they are at a high altitude above the sea level.

For example, in San Luis Potosi we have several of the conditions of an elevated climate, amongst which are the following: An elevation of 1,890 metres above the sea level, a dry atmosphere under very good conditions, a summer which is warm for Mexicans and a winter with a very low mean temperature.

These last conditions are very favorable for an elevated climate, but on the other hand, we have the advantage of an even mean temperature and the elevation above the sea level. To this ought to be added the fact that the climate of San Luis Potosi is really of great benefit to persons suffering from tuberculosis, that there are a few cases there of pneumonia, a disease which I understand causes great ravages in the city of Zacatecas, though that is very probably famed as a good specimen of an elevated climate.

With respect to water, it appears to me necessary to practise daily observations with the view to finding out whether it is good or bad for drinking purposes, and the same may be said with respect to tuberculosis; and as in Zacatecas there is a good deal of pneumonia, that is another reason for not complicating this disease with tuberculosis.

This latter disease is at present the object of careful study in the United States and all the rest of the world, and you will remember the great excitement that was caused by the supposed discovery of lymph by Dr. Koch; there was a perfect invasion of physicians in Germany, who all went with the special object of studying this discovery, which at that time was thought to be effective. I therefore hope that out of this meeting will arise many careful studies on this particular branch, whether by the Mexican or foreign physicians, who have given so much attention to the question of tuberculosis. I hope, that like Dr. Orvañanos, they will undertake careful studies, not only of the localities, but also of the humidity, the relative atmospheric humidity and the frequency with which complications are found which might hasten the progress of the tuberculosis.

Our North American companions would then be perfectly able to determine the points to which they ought to send their patients, bearing in mind the different periods to which the disease may have arrived, as described by Dr. Carbajal. I sincerely hope that at the next meeting of the American Association we will be able to show a geographical table determining in the most complete points,—firstly, the elevated climates in the Mexican Republic which are beneficial to tuberculous patients in every stage of the disease and in every season of the year.

Adjourned.

AFTERNOON SESSION.—3 O'CLOCK.

The afternoon session was called to order in the main hall of the National Preparatory School, at 3 o'clock, by the President, Dr. Formento.

THE PRESIDENT.—Gentlemen, before we begin the afternoon exercises I wish to say that those who have not received invitations for the evening entertainment in the National Theatre, will be admitted upon presentation of their badges, without further invitation. Some persons have thought it was absolutely necessary to appear in full dress this evening, but that is not so. All who desire may wear evening dress, but it is not obligatory to do so.

The first thing in order this afternoon is a paper by Dr. W. M. Yandell, on "Contagious Diseases on the Rio Grande Border." (See page 318.)

(Dr. Yandell not being present, his paper was read by Dr. Gihon.)

The next paper is "On Some of the Infectious Diseases," by Dr. William T. Corlett. (See page 90.)

THE PRESIDENT.—Gentlemen, the paper is before you for discussion.

DR. ALBERT L. GIHON.—I think the Association should take some notice of this paper. Too much attention is being given in this country and in the United States to the subject of cholera and too little to the question of consumption. It is a fact that consumption is killing more people than cholera, yellow-fever, and all other contagious diseases together. Two years ago in Charleston I was in a steamship with thirty or forty consumptives, and there was coughing and spitting and gagging, and the air was alive with the microbes. Coming here the other day I was in a Pullman car with a consumptive, and I am not quite sure that my lungs are not used up in consequence. If consumptives are to be allowed in railway coaches they should be given special cars or a special compartment in the cars, so that not all the occupants need be exposed to their hawking and spitting and coughing. As it is now, they are given berths in a Pullman car, and the same mattresses and blankets are used for the next occupant of the berths, without any cleansing or disinfection, and your wife or mine is liable to receive the infection of the disease from this source if they travel by rail. I rise simply to open this discussion, and I hope this Association will give serious attention to the matter. It is the little things that we must attend to. The whole nation is aroused to keep cholera out, and this is the easiest of all diseases to destroy; but tuberculosis, to my mind, is much more dangerous. It would be much better if there were a little less choleraphobia and a little more tuberculosis. With respect to the other diseases mentioned in the paper just read, I am satisfied that the proper attention will be given to their restriction and prevention, but I consider tuberculosis and cholera the two most important maladies to which we have to turn our minds. I am glad Dr. Corlett has called our attention to this subject, and I trust we shall give it due consideration.

Dr. W. P. Roberts.—I am glad the attention of this body has been called to the subject of tuberculosis. I was a consumptive, doomed to die—pronounced incurable by five physicians. I changed my residence to a more favorable locality, and am alive to-day, after thirty years. My attention has been given very largely to the subject of the prevention of consumption for the past few years. Animals as well as man are subject to tuberculosis, and at a meeting of veterinary surgeons last summer it was proposed to petition congress to appropriate a sum of money for the eradication of the disease among the cattle of the United States. Consumption causes more deaths in New England in one year than cholera in fifty years. It is high time this great body of sanitarians should consider the subject of the prevention and restriction of tuberculosis.

Dr. Nicolas Ramirez de Arellaño.—The question which is now being discussed, is certainly of the highest importance. The prophylaxis of tuberculosis has up to a certain point been neglected up to the present date; and there is not the slightest doubt that the most careful hygienic measures ought to be applied to this contagious disease.

Unquestionably the disease often presents itself by contagion, and if it does not do so in all cases, it very clearly does so in many which we know of.

Shortly after my arrival from my last trip to Europe, I had occasion to see my first patient after reaching this capital. This was a young woman who was evidently the victim of contagion; the antecedents of her family were perfectly free from any signs of hereditary disease; she was in robust health and in a state of pregnancy. She went to live in a house which had been occupied for a long time by a tuberculous patient, who eventually died in it. The walls of that house may be said to have been lined with purulent expectorations and bloody stains. In the corner where the patient had died the bed of this young woman was placed, and soon afterwards she herself was attacked with tuberculosis. The disease progressed so rapidly that the patient died in a very short time.

I made careful inquiries, so as to find out if in this case there was any hereditary disease, and I was perfectly convinced that there was not the slightest tendency to such disease in her family.

I believe that this case is one of those that clearly indicate the necessity of isolation, perhaps not absolute, as that would be difficult to practise, but at least a partial isolation, as well as the necessity of complete disinfection of the rooms and the objects which have been used by the patients.

This measure, which up to the present day has not been considered as a necessity and has not been provided for by law, should be, in my opinion, strictly carried out, because it would certainly tend to save the lives of many persons who might otherwise be infected.

The observations which we acquire in our medical practice clearly indicate to us the necessity of establishing precautionary measures which will be as rigorous as those which are now taken against the other contagious diseases.

On the other hand, I am of the opinion, that besides the precautions that I have already indicated we ought to establish a strict inspection of live animals, with the object of discovering if they have any disease, and in such case, of separating them in due time and preventing them from being brought to market. For this purpose we could use the tuberculin of Koch, in order by this means to fix the diagnosis, even before the disease completely manifests itself. This practice could very well be followed in the public markets and slaughter-houses, where the diseased cattle should be carefully and strictly separated, as well as all animal products which might be affected with tuberculosis.

Dr. Licéaga.—I did not desire to take any part in the discussion which has arisen on this subject, as I did not come in any way prepared to do so; but as I consider this question of the very highest importance, I should like to see Dr. Corlett's paper thoroughly considered, as it appears to me to be of the greatest value.

If I now rise to speak without any previous meditation, it is only on account of the great importance of the subject under discussion before the Association.

Heredity has always been considered one of the most important factors in the propagation of tuberculosis, and it is certainly painful to see how every day the most beloved relations are lost within a short time of their birth, from the tuberculous affections of the parents.

This matter is of such grave importance, that even at the risk of tiring the attention of my fellow members, I cannot allow the opportunity to pass without speaking a few words on the subject.

Hereditary tuberculosis not only carries off very young children in the special form of cerebral pneumonia, but it also develops itself at all ages, and it is when they arrive at the age of adolescence that they feel the pains in their articulations and bones. Later on comes the gramilia, that destroys them in a very short time, and if it has respected them at this period of life, it always reaches them later on through different kinds of pulmonary affections.

I have a terrible example of this class of heredity to relate to this meeting; it is a case of a family resident on one of our coasts. Of the members of this family, some on the arrival at the age of adolescence, and others immediately after passing that age, began to suffer from a slight cough, which gradually got worse, until at last it developed in a perfectly defined case of pulmonary pthisis.

Within a year the first member of the family died, and hardly was she buried before another of the young people who had arrived at that age began to feel the symptoms of the disease, with the same characteristics and under the same conditions. About the time when this patient died, another began to complain; and this happened six times in the same family, with members ranging from three to six years of age.

I repeat, that it is only necessary to consider the terrible misfortunes of that family, the parents of which knew perfectly that their children could only grow up to die at the age of puberty, to comprehend that this is a very

important and delicate point, and that I find myself obliged to call the attention of this important meeting, and to take advantage of the opportunity of the American Public Health Association, to raise this important question, which I feel myself unable to resolve without your valuable assistance.

In view of the facts which I have lightly touched upon, I propose that by all means in our power, either by the law, by the boards of health, by the papers, by means of books, and by all resources at our command, we should prevent the marriage of persons afflicted with consumption.

If this result could be obtained, we should have rendered an immense service to humanity, because we have to think not only of the individuals who are carried off by death, but of the well-being of the generations which are to follow.

As citizens, we are under the obligation of caring, not only for our children and grandchildren, but also for other generations still further off.

The idea that I now initiate is not one that can be determined on at this time and place; here we can only initiate, here we can only employ the intelligence, the energy, and the good-will with which we are endowed to spread these ideas throughout the entire world.

Separation, disinfection, and isolation are the necessary measures which must be employed when there are no others available; but, above all, it is necessary that the evil should be stopped at its fountain-head, in order thus to prevent its future spread. This is the idea that I should like to see advocated by this Association, which has such great influence with the entire world.

Dr. Henry B. Baker.—We acknowledge the fact of the wide distribution of tuberculous consumption and its transmission to individuals, and the question is, What can and shall be done to prevent its spread? There are many methods to be recommended, and the first is disinfection of all the sputa of the patient. Another is isolation of the invalid. This is not an individual or state question, but a national question, and many a sanitarian has accepted the opinion that by proper isolation and disinfection of the excreta of tuberculous persons, the disease could be stamped out in a few generations, and I believe it to be the duty of this Association to put forth every effort in the direction indicated.

Dr. Pinckney Thompson.—I suppose there are but few members of this Association, especially those of the United States, who do not fully concur in the opinion that tuberculosis is communicable, and it seems to me that atmospheric influence—I shall use that term—has a great influence in its distribution. Studying the statistics of the disease we find that in the New England states and in the Northwestern states the mortality from tuberculosis is greater than from any other disease, and this proportion is maintained in all the states coming south until we reach Tennessee, where it begins to lessen; and when we reach this country we find that there are states in this republic where the disease is unknown. For this reason I conceive the idea that tuberculosis is not only communicable, but that certain atmospheric influences promote it.

I believe that it is the exception to the rule that it is hereditary. I believe that a predisposition to it may be hereditary. But the question is, What shall be done to stamp out this disease? I believe that boarding-houses, boarding-schools, and railroads are among the fruitful sources of its spread. I believe, with Dr. Gihon, that if consumptives are to be allowed to travel about in railway coaches they should be given special apartments, and not be allowed the indiscriminate use of sleepers. It seems to me that would not be cruelty, and it would remove one of the sources of greatest danger to which travellers by rail are now subjected.

In the next place I think that wherever in our practice we find tuberculosis, we should impress upon that family or that individual the importance of disinfecting the discharges and the sputa, and that tuberculous persons should not occupy the same room at night with another individual—much less the same bed. The thought should be impressed upon them, that by thoughtless and careless intercourse with others they are endangering the lives of other individuals and doing themselves no good.

I believe that tuberculous matter expectorated upon the street becomes dried and is distributed by the wind, and no one is free from the danger of its invasion. In the cure of the disease I have no faith, but if there is any place in the country where it will not develop, that is the place for people inclined to the disease to go.

Dr. Howard E. Ames.—It seems to me the principal point is to trace out the disease. I think there is not a board of health in our country that requires physicians attending cases to report them, and unless that is done I do not see how the disease can be controlled. Railroads do not stop to ask whether a man has tuberculosis or not before selling him a ticket, and unless local authorities can control the individual I do not see how we can control the disease. In the first place the states should pass laws compelling every physician to report every case of tuberculosis, and to look after the family and keep a record of them and educate them in the treatment of the disease and how it is to be avoided. Every patient should be isolated from the other members of the family, and they should be impressed with the fact that the discharges are as deathly as poison.

Dr. J. D. Plunket.—I think we have a committee appointed to investigate this question which is being discussed, and I think we should have a report from that committee.

Dr. Henry B. Baker.—I think we have such a committee, and that there was to be a report at this meeting, and it would be a good idea if it could be presented both in English and in Spanish.

The President.—Dr. McCormack, chairman of the Committee on the Prevention and Restriction of Tuberculosis, was unable to be present at this meeting, hence there will be no report at this time.

Dr. Albert L. Gihon.—The discussion of the restriction and prevention of tuberculosis is not a new departure for this Association. A resolution was passed some years ago, recommending that tuberculous sputa

should be destroyed. There is at the present time in use in the United States a paper to receive the expectorations of consumptives, and in Germany they have a glass cup with a silver mouth-piece, which can be carried in the pocket; but I would like to know how many physicians here present require their patients to use these cups. Before we can control this disease we must formulate rules and have them enforced by law. We have in this Association an admirable committee on this subject, and I am very sorry they cannot report at this meeting. I should like to have this committee continued and have them render a report at the next meeting, the report to be in both English and in Spanish, and I offer the resolution that the committee on the Restriction and Prevention of Tuberculosis be continued, and render their report in English and in Spanish at the next meeting of the Association.

Dr. J. D. Plunket.—I would like to ask of Dr. Baker if his committee has had a conference and if they are ready to report.

Dr. Henry B. Baker.—The committee is not ready to report at this time, but if Dr. Gihon's motion prevails I think the committee will make a report. It is the duty of the retiring president to appoint the new committees, and he may see fit to change the committee. This subject is of too great importance to be neglected.

Dr. Gihon.—I move that the committee be continued and that the report be incorporated with the transactions of this meeting.

Dr. Chico.—Seconding the motion made by the learned physician who has preceded me, I propose that an International committee should be formed, which should condense into the form of resolutions, and in both languages, the ideas which have been expressed.

Motion carried.

Adjourned.

EVENING SESSION—8 O'CLOCK.

The evening session was held at the National Theatre. The meeting was called to order by the chairman of the Local Committee of Arrangements, Dr. Eduardo Licéaga.

Address by Dr. Eduardo Licéaga, (See page 15).

Address by Sr. Lic. Juan Bribiesca. (See page 25.)

Address of the President, Dr. Felix Formento. (See page 1.)

SECOND DAY.

Wednesday, November 30, 1892.

MORNING SESSION—9 O'CLOCK.

The Association was called to order at 9 o'clock, by the President, in the Chamber of Deputies.

Announcements from the Local Committee of Arrangements, Dr. Licéaga.

Dr. Licéaga.—Gentlemen, the arrangements made for to-day are as follows: After adjourning the session, a visit will be made between 1

p. m. and 3 p. m. to the Museum of Antiquities, which I strongly recommend to your special attention. I hope that it will not happen in this case as it has happened in others, when members have gone to these public establishments at times when they were not expected and when the employés could not be present to give them the necessary explanation. This visit to the museum is specially interesting, and I hope that you will meet in the Hotel Iturbide at 1 o'clock in the afternoon, so as to go there.

After the ordinary meeting, which will take place the same as every other day, in the National Preparatory School, the members who feel that way inclined are invited to visit the American hospital. The members of the congress are invited to a reception to-night by the municipality of Mexico, and to attend this you do not require more than your badges.

I must now announce a change of programme for to-morrow. As General Diaz to-morrow at 10 o'clock takes possession of the Presidency of the Republic, the legislative corps will tender him a banquet at the same hour at which, according to our programme, we were to have attended a reception at the Jockey Club, and as neither the Secretary of the Interior, who is president of the club, the other ministers, or the deputies and senators will be able to go, it has been thought most convenient to postpone this reception to Saturday, the 3d.

On Friday, the 2d, there will be a grand serenade and fireworks in the principal square, to which all the members of the Association are invited.

Reports from the Executive Committee.

Election of members. Upon motion of Dr. Gihon, the Secretary cast the ballot of the Association for the election of the new members.

Roll-call of the Advisory Council.

The Secretary read the amendment to the Constitution offered at the last meeting of the Association, which confers upon the Republic and states of Mexico, the right to representation in the Advisory Council, as follows: "To amend section 10 of the Constitution of the American Public Health Association by inserting after the word 'province' the following words: 'The Republic of Mexico and each of the Mexican states.'"

Adopted.

THE PRESIDENT.—Each state is entitled to one representative in the Advisory Council, and as the names are called if there is any person present from the respective states he will please make his presence known.

The roll-call of the Advisory Council then continued.

Report of the Treasurer, Dr. J. Berrien Lindsey.

The Treasurer's report was referred to the Auditing Committee, Dr. H. P. Walcott, Dr. A. W. Cantwell, and Dr. Domingo Orvañanos.

The first paper presented was on "The Sanitary Relations of Texas and Mexico: The Official Correspondence relating thereto." By R. M. Swearingen, M. D., State Health Officer, Texas. (See page 323.)

DR. LICÉAGA.—As the paper which has just been read treats of a question whose discussion is of the greatest interest to ourselves, I move that the paper, which unfortunately has not been translated for want of

time, be held for discussion until the Mexicans have been able to read it, so that we may be able to take a part in its discussion. I therefore beg that the paper be referred to myself, so that I may be able to answer it in the afternoon session to-morrow.

This motion was carried.

Dr. J. D. Plunket offered the following resolution:

WHEREAS, The subject of hygiene is now taught in the public schools of the United States of America, at the Universities of Pennsylvania and Virginia, at Harvard, Yale, Bowdoin, and other colleges, and at the Naval Academy at Annapolis, Md., and

WHEREAS, Military hygiene, as a branch of the general art of war, including the subjects of shelter, heating, ventilation, water-supplies, food, disposal of sewage, and the clothing and physical training of troops both in peace and in war, should be recognized as a necessary and important part of the curriculum at all medical schools, and

WHEREAS, This important subject forms no part of the curriculum at the U. S. Military Academy at West Point, N. Y., therefore, be it

Resolved, That a committee of this Association be appointed to urge upon the congress of the United States the advisability of introducing the subjects of physiology and hygiene in the course of study at the military academy aforesaid.

Resolution referred to Executive Committee without discussion.

Paper on "Defence of the Ports and Frontier Cities of Mexico against the Epidemic of Cholera that invaded Europe and was on the point of invading the United States this year." By Dr. Eduardo Licéaga. (See page 240.)

Paper on "A Modification of Inner Quarantine Regulations as especially applied to Epidemics of Yellow-Fever," by D. B. Blake, M. D., Cuero, Texas. (See page 320.)

THE PRESIDENT.—As these three papers are all upon the same subject, and as the discussion of the first has been postponed until to-morrow, I would suggest that the discussion of the last two also be postponed until that time. Suggestion adopted.

Paper on "Yellow Fever," by Dr. Manuel Carmona y Valle. (See page 265.)

After concluding the reading of his paper, Dr. Carmona said: Unfortunately, the evaporation has not been completed, and therefore we have not been able to obtain the liquid which I have had the pleasure of showing to the meeting in its normal consistency. It is a solution that as yet has not been fully evaporated, but that presents the typical characteristics of which I have spoken. If the President thinks convenient, he might appoint a commission to examine it privately and to report the result of its examination to the meeting. I place myself entirely at the disposition of the President.

Before retiring I want to say, that after having written this paper I not only discovered the presence of this micro-organism in the liver, but also in the kidneys, in which these are sometimes to be found.

THE PRESIDENT.—Gentlemen, if you wish to see the specimens used to illustrate this paper, they are here at your disposal. Dr. Carmona has suggested that you appoint a committee to inspect them more minutely and report to you upon the same.

The last paper on the programme was on "Prophylaxis of Hydrophobia in Mexico," by Dr. Augustin Reyes. (See page 138.)

Adjourned.

AFTERNOON SESSION.—3 O'CLOCK.

The meeting was called to order at 3 o'clock by the President, in the National Preparatory School of Medicine.

The first paper presented was "Notes on Croup, in the City of Mexico, and Prophylactic Measures Against Its Growth," by Dr. Juan Ramirez de Arellaño. (See page 74.)

DR. REVUELTAS.—Before Dr. Ramirez de Arellaño commences to read his paper, I should like to propose that a careful study be made of the following points: For what reason is yellow-fever not endemic on the coast of the Pacific, while it is on the coast of the Atlantic, and that not only in our own Republic, but also in the neighboring Republic? Should this idea be accepted, I propose that the Secretary of the Association should move both the Superior Board of Health and the Department of War, in order that they should give a careful study to the question.

DR. GAVIÑO.—With respect to the interesting question which has just been treated of, I would like to mention a fact which has been observed by Dr. Carmona y Valle. At the time of the French invasion, croup appeared in this country; but before that time, cases of false croup, or pseudo-croup, had been observed, in which symptoms were developed, not of the serious class of the diphtheria which we are now acquainted with clinically, but the attenuated disease, one of whose results was the after-paralysis that developed some time after, but without the appearance of the dyspnoea of croup. This perfectly agrees with the teachings of to-day, which show us that an attenuated microbe exists, which, under certain conditions, will have the virulence, and will produce the diphtheretic affection, as at present known under all its clinical forms.

With regard to this point, I should like to bring before the congress the very great importance of microscopical observation in all cases where the presence of croup is suspected.

I have lately had opportunities of proving that before the appearance of any grave or visible manifestations in the patient, the existence of the Klebs-bacillus can be easily proved, and that it gives a colony in twenty hours. This resulted in my discovering the point of departure of the croup, and hence I was also able to discover that the house in which my patient lived had been inhabited seven years before by a person who sickened and died of this affection. After the latter died, a brother of his was affected; after that his mother, who was thirty-two years of age, and in spite of the medical assistance they received, the two children died, though the mother was saved.

The statistics which are presented by Dr. Ramirez de Arellaño, speak eloquently with respect to the period when this disease was studied by Dr. Yersin, but at the present day, the mortality caused by this disease

in all civilized countries has been considerably lowered through the improved methods employed for disinfection. The methods of disinfection, by means of carbolic acid and oil of cloves, have resulted in the extirpation of the membrane and completely dislodges the toxine, which is what poisons the individual, and by performing this operation we provide the patient with defence against the organism, we procure the attenuation of the microbe, and consequently the cessation of danger of subsequent infection.

I can cite another very interesting case, and it is that of a child of my own family, who took diphtheria through living in a house where that disease had occurred nineteen years before.

This child succumbed to the disease, because, when the diagnosis was made, the disease had advanced too far.

These facts which are so interesting with a view to the diagnosis of the disease, before our clinical studies can point them out with certainty, are of the greatest importance, and the meetings of this Association ought to do their best to extend as far as possible the study of the bacteriology of the false membranes of the larynx, as recommended by Dr. Ramirez de Arellaño, in the first of his conclusions. In many cases, wherever a laryngeal affection begins, there is the spot where the bacillus lodges, and diphtheria results.

The following resolution was offered by Dr. Juan Arellaño:

WHEREAS, In view of the excellent papers presented on the subject of yellow-fever, steps should be taken to inquire into the reason why yellow-fever is constant on the Atlantic coast and why it is not endemic on the Pacific coast, having appeared there but twice during the present century, therefore,

Resolved, That the Superior Board of Health of Mexico should make proper investigations into the matter, and assisted by the army surgeons, should make a direct communication bearing upon the disease.

Resolved, That this Association, through its President and Secretary, obtain all possible data upon the prevalence and causation of yellow-fever, as it prevails in the United States and Mexico, and report at the next meeting of the Association.

Referred to Executive Committee.

The second paper read was "Relations of the Weather Service to Sanitary Science," by Mark W. Harrington. (See page 37.)

DR. HENRY B. BAKER.—I understood Professor Harrington to say that the weather bureau would gladly furnish sanitarians with whatever data they might desire from that department, and I would move the appointment of a committee of this Association on that subject, to confer with the Chief Signal Officers of the United States and this country, in regard to taking special steps to secure data bearing upon the question of meteorological changes and disease.

DR. ALBERT L. GIHON.—I move, as an amendment, that the committee consist of five members, with Professor Harrington as chairman.

PROF. MARK W. HARRINGTON.—I should much prefer that some sanitarian be made chairman of the committee. What we want to know is, the desires of the sanitarians. I can tell you what we can give you; what we want to know is, just what it is that you want.

Dr. William Bailey.—I think it most proper that a sanitarian should be made chairman of the committee, as Professor Harrington is on the side to be consulted, and I would suggest that Dr. Henry B. Baker be made chairman of the committee.

Dr. Albert L. Gihon.—I accept the amendment.

Dr. Henry B. Baker.—I think Canada should be represented in the committee.

The President.—Nothing has been said as to the composition of the committee; that will be left to the chairman.

The motion that a committee of five be appointed, with Dr. Baker as chairman, was duly seconded and carried.

The next paper read was entitled "Etiology and Prophylaxis of Exanthematic Typhus," by Dr. Nicolas R. de Arellaño. (See page 81.)

Dr. Jesus Chico.—I only rise to add a few words to the data which has been given to us by Dr. Ramirez de Arellaño.

In the year 1875 a brilliant discussion took place in the Academy of Medicine in Paris, the deduction from which may be summed up as establishing the fact that 75 per cent. of the epidemics are produced by the fæcal matters without any mixture of excreta.

In that discussion, the fact was brought forward that in a certain college where there had been an epidemic of typhus, the most numerous and the most serious cases occurred amongst the pupils in proportion as their seats or places were nearer to or further from a particular closet.

The well known fact adduced by Dr. Ramirez de Arellaño, is certainly very much to the purpose. Six years ago I published in Guanajuato a paper showing the causes of the increase of typhus in Mexico, and how the change from the old system of carrying the night-soil out of the city in barrels; and this fact has a great deal to do with what has happened in the cities of the French coast, I mean that part which forms a prolongation of the Italian coast, and is called the Riviera. These, and many other cities of the coast, used to be entirely free from typhus, and in them was followed the same system as in Mexico, of carrying the night-soil out of the city in barrels, although on that coast they used even to employ donkeys for this purpose.

When the European doctors discovered the splendid conditions of the climate of that coast during the winter-time, immense numbers of visitors overran the country; the municipal councils of these cities, feeling ashamed of the disgraceful spectacle presented by that system of hygiene, determined to put in proper drains and sewers; but as they were short of the requisite funds, these important works were made in a rough and unscientific manner, thereby bringing on the natural result, in the shape of typhoid fever.

With respect to the typhus in our own country, I desire to add a few words to what has already been said by Dr. Ramirez de Arellaño, and it was for that purpose that I asked permission to speak.

There is a most singular fact existing in Guanajuato; up to the year

1866 the public prison was a pest-house worthy of the Middle Ages, and the agglomeration of filth was something unspeakable. An epidemic of typhus came on, which commenced in the Three Years War, continued during the French invasion, and even afterwards; this epidemic decimated the population of Guanajuato, but nevertheless the disease did not attack any of the prisoners in the jail, in spite of the terrible condition in which it was kept. There is this to be said in connection with that remarkable case of impunity, that the night-soil deposited within the prison was always carried outside.

The prison was moved to a locality which is notoriously better situated, and in which closets were placed, and then the prisoners fell victims to typhus. Typhus has lately reappeared amongst the prisoners, in spite of the improvements which have been made in the building.

The epidemic of typhus in Guanajuato, at least speaking of the last two which have been observed by my brother-delegates and myself, during the years 1884 and 1886, when they really terrorized the inhabitants, have always been preceded by an accumulation of night-soil.

For example, during the year 1883, all the sewers had been filled up with this night-soil, and when the rainy season arrived, during the month of June, the rain, which fell in torrents, so as even to interrupt communications, drove all this accumulated filth out of the sewers, and typhus immediately appeared.

Four years ago typhus commenced to invade all the towns in the neighborhood of Guanajuato, and principally Leon. It then extended to other towns in the neighborhood, until last year, when the rain was very scarce; the night-soil has thus accumulated afresh, and if this year we have the annual heavy rains, all these matters will be thrown out without any disinfection, and we will have a fresh epidemic of typhus, which is already assuming the most alarming proportions.

I know of a great many cases which I could bring forward in support of the arguments of Dr. Ramirez de Arellaño, but in my opinion, and I believe in the opinion of the greater part of my colleagues, there is no doubt that the fæcal matters are the principal causes of typhus.

Dr. Manuel de Anaya.—I take the liberty of addressing a few words to this Association,—in the first place to congratulate Dr. Ramirez de Arellaño, with whom I have not the honor of a personal acquaintance, but with whose observations on the subject of typhus I entirely concur; I also congratulate him for the prophylactic measures which he proposes, and which in my opinion are excellent, and will certainly give the best results if they are only attended to and put in practice by the state and federal authorities of the Republic.

Nevertheless, I should like to have heard from the lips of this distinguished physician, his opinion as to the reason why this terrible disease confines itself to certain localities of the central table land and to certain points of the Republic, and why, as it advances towards the coast, it disappears, when the miasmas which cause the typhus in the more elevated regions are to be found on the coast as well.

In the central region of our coasts we have the same agglomeration of people, the same misery, the same localities infested with miasmas, the same putrefaction of night-soil, and in one word, we have there all the causes which have just been indicated by Dr. Ramirez de Arellano.

I do not pretend to raise any discussion on the matter, except with a view to resolving my doubts, and I should be very pleased to hear his valuable opinions on such an important subject.

I repeat, that in previous years I have had opportunities of travelling over the central table land, and everywhere I found the same symptoms of typhus, and the same causes for its appearance, that with so much talent have been explained by our distinguished colleague. This journey was undertaken in the years 1861 and 1862.

The science of bacteriology of to-day attributes all diseases to the microbes of specific classes and denominations.

This is another theory that in my opinion still requires a careful study with respect to the exanthematical typhus which is found in the Mexican Republic, and which is the same that has been developed in Ireland and other points of the British Isles. This class of typhus is different from the abdominal typhus that for so many years has been studied in the French school.

If the microbe is really proved to be the original cause of these diseases, we find ourselves with another question to study, because, as was very well said this morning by Dr. Carmona y Valle, in the learned discourse to which we listened, this is a new school that now presents itself, and which still demands a great deal of careful study before it can be brought to perfection.

Dr. Carbajal.—The origin of typhus, and the fact of its being caused by the fæcal matters, appears to me to be clearly proved. In this capital especially, we, the sanitary inspectors, who have frequent occasion to visit the houses, find abundant proofs of this assertion, and the other towns of this country can derive the very greatest benefit from this discussion.

We have amongst us all the possible styles and classes of closets, from the rudest and most primitive, that is to say, from those that are merely formed of a hole in the ground without any kind of ventilation, up to the most perfect, which are called English closets, and which are found in this capital and in a few of the larger towns; we also have all the systems for discharging these matters, also from the most primitive, which consists in extracting the night-soil every day from the houses by means of a box or movable vessel, up to the system of sewers with a current of water, such as is found in Cuernavaca, where there is an abundance of disposable water, which permits the night-soil to be carried off with a degree of perfection that cannot be obtained in Mexico.

It being demonstrated that such is the origin of typhus, the most practicable plan would appear to be to make a daily extraction of these deposits; but this is only possible in small towns and even there with a good deal of difficulty, whilst in the large cities, such as Mexico, it

would be almost impossible. Nevertheless, this is the practice that gives the best results where it can be carried out.

Dr. Ramirez de Arellaño has called attention to the defects of our present sewers.

The sanitary physicians find proofs at every step, that if the sewers are not in a perfect condition they are at least in a fair condition, but that the house drains are not properly discharged; and then happens what we see in many cases, and what has given rise to many complaints, even in the press, and that is that the ventilating tubes, and even the hydraulic stench traps, throw off considerable quantities of gas, with great inconvenience to the inhabitants of the houses and of the immediate neighborhood.

Many complaints have lately been made on this subject in the newspapers, and by persons who do not belong to the medical or engineering profession. It appears to me that the hydraulic stench traps, the cesspool closets, and the ventilating tubes cannot give perfect results unless the house drain itself is perfectly clean, and this can only be the case when they are thoroughly discharged into the sewers.

In conclusion, I would ask the meeting to fix its attention upon this point: That these evils can be remedied if a system of ventilation is established, even if it is only in a temporary manner, where it is most urgently required, and that is, in the sewers.

Paper on "How to Render Malarious Localities Salubrious," by Dr. Charles Smart. (See page 307.)

Adjourned.

THIRD DAY.

THURSDAY, December 1, 1892.

No morning session.

AFTERNOON SESSION—3 O'CLOCK.

The meeting was called to order by the President at 3 o'clock, at the National Preparatory School of Medicine.

Prayer by Rev. Hugh McDonald.

Announcements from the Local Committee of Arrangements.

DR. LICÉAGA.—I desire to remind the members of the Association, that the reception which was fixed for to-night, at the Jockey Club, will not take place until Saturday, the 3d, because the Legislative Corps tenders a banquet to the President of the Republic, to which several members of the Jockey Club will have to go, and especially the president of the club, who is Mr. Romero Rubio. I would also remind the members that to-morrow we have to make a visit to the Maternity Hospital and the School of Fine Arts.

Report of the Executive Committee.

Reports of committees.

Report of Committee on Sanitary and Medical Service on Emigrant Ships. The following resolution concluded the report:

WHEREAS, The unprecedented solicitude felt by the American people on the approach of cholera from Europe in 1892, with its attendant interruption of commerce and travel, may be repeated with added terror in 1893, and

WHEREAS, The paramount danger of introducing cholera and other dangerous diseases into this country from the eastern continent, lies with the emigrant, his baggage, and the unfavorable conditions of his voyage, it is therefore

Resolved, That in the opinion of the American Public Health Association the emigration laws of the United States, Canada, and the Republic of Mexico should be so altered or framed as to provide for the greater safety and welfare of passengers and seamen on shipboard, and the protection of the several countries against the importation of dangerous diseases.

That all emigrants and baggage shall have such scientific treatment before embarkation as to warrant and be attended by a certificate of freedom from the power to communicate a dangerous disease.

DR. ALBERT L. GIHON.—In rising to second this resolution, I desire to say that the only exception I take to it is its moderate language. Unless you have seen the steerage of a German emigrant ship you can have no idea what it is like,—over-crowded, poorly lighted, filled with men and women who have never washed since their birth, with their bundles of old clothes, and many of them suffering from seasickness, and you have a mess that is indescribable. The point of this resolution is to urge some legislation that will prevent the steamship companies from overcrowding their ships in this way, and to compel them to maintain cleanliness on board their vessels.

DR. OLLIFANT.—I understand the resolution provides for the disinfection of persons and baggage at the port of departure only.

DR. S. H. DURGIN.—It was not the purpose of the committee to provide for anything that is done on this side of the water, but to provide that something shall be done before the emigrants embark for this country.

Dr. PETER H. BRYCE.—Before the resolution is put, I move the following as an amendment:

Resolved, That the Committee on Sanitary and Medical Service on Emigrant Ships be continued, and instructed to draw up a report dealing with the details of such improvements, and to report the same at the next annual meeting of the American Public Health Association.

In drawing up their report the committee should give the particulars in detail as to what legislation is needed. It seems to me that in passing a resolution of this kind, much depends upon the particulars that are furnished to those governments which are to be asked to act upon them, and who will respect our opinions as the representative sanitarians of these countries, and the committee should draw up a detailed report and urge its adoption upon the general government.

DR. C. N. HEWITT.—These matters are to be discussed this afternoon, therefore I move the postponement of the resolution until after the further discussion of the report of the committee.

DR. P. H. BRYCE.—I withdraw my amendment.

DR. LICÉAGA.—I propose to condense my remarks to as few words as possible.

Dr. Swearingen read a paper at yesterday's morning session, and I requested permission to study the matter so as to be able to answer. That paper can be reduced to these points: Dr. Swearingen asked that the quarantine against ships arriving from Tampico (he resides in Texas) should be instituted. The government of Mexico protested against that quarantine on the ground of insufficient reasons. The Supreme Board of Health of Mexico city opposed the establishment of any such quarantine, and the question finally resolved itself into the following proposition:

Resolved, That delegates should be appointed by this Republic, who should join sanitary delegates from Texas in the study of this question, and in the determination of a plan which should be least prejudicial to the interests of commerce.

This resolution was forwarded to the chief of the Medical Department of the United States Navy, who answered that he could not possibly go to Mexico twice, and that, seeing he should attend the meetings, in Mexico, of the American Association of Public Health, the question should be postponed to that occasion. This is what transpired yesterday.

The demands presented by Dr. Swearingen in his paper are: That means should be provided for reciprocal defence between the two nations and on the Texan frontier.

The question was already settled when Dr. Swearingen moved the question in the state of Texas, requesting the imposition of quarantine, on vessels proceeding from Tampico. The federal government of this Republic had not been able to organize the sanitary service which we now have established in all frontier points of the Republic, but now that this Service is properly organized, such a proposal as this has no object.

Article 22 of our Sanitary Code says as follows: [Art. read], and Article 24 says,—[Art. read] and Article 27, says,—[Art. read].

You will therefore see that the laws are amply sufficient, and though they could not be carried out at that time, we are now in a position to fulfil all their provisions.

But there is more yet; in yesterday's session I said that we would not only defend ourselves from the diseases which might be brought to us from the United States, but that with our disinfecting stoves we would defend the United States from diseases which could be carried to them. I desire to improve this opportunity to make a proposition which is relative to this question.

Dr. Formento, our esteemed President, stated in his speech of the night before last, that if the American Association of Public Health should succeed in calling together an international convention, which should study all the questions relating to yellow-fever, and should establish an international committee to provide for the defence of both nations, it would effect a grand and meritorious work. The motion which I now propose is intended to carry out the idea thus indicated:

WHEREAS, Yellow-fever is one of the scourges which causes many deaths in the localities where it exists endemically, and

WHEREAS, Yellow-fever is the principal agent that impedes the development of the localities indicated, and

WHEREAS, The disease is a serious obstacle to the social and mercantile relations of the United States and the Republic of Mexico, so they cannot reach the state of intimacy and grandeur so much desired, therefore be it

Resolved, That an international committee of seven, with Dr. Formento as chairman, be appointed with the objects:

1. To collect all data relating to yellow-fever along the coasts of the United States and Mexico.

2. To study the best measures to be adopted to secure the extinction of the fever.

3. Also to study the most efficacious measures to impede the importation and propagation of the disease in those places which are ordinarly exempt from it.

The committee will appoint from among its members a sub-committee, which will undertake the study of reciprocal defensive measures to be adopted in both republics against all other transmissible diseases.

DR. HEWITT.—I have the idea that the committee should be composed of representatives of the United States, Canada, and Mexico, and that they should take into consideration the matter of quarantine between the three nations. Further than this, this committee should form an international committee, to report at the next meeting of the Association in Chicago, upon the whole subject.

Resolution referred to the Executive Committee.

DR. BUSHROD W. JAMES.—I desire to offer a resolution, to go before the Executive Committee, and will do so at the present time, at the request of several New York sanitarians:

Resolved, That in view of the impending danger of cholera in 1893, it is the opinion of the American Public Health Association that a National Health Service should be established in the United States, as has been done in the Dominion of Canada and the Republic of Mexico.

Referred to the Executive Committee without discussion.

DR. OLLIPHANT.—I move that that resolution be tabled.

THE PRESIDENT.—It is for the Executive Committee to decide that point.

DR. OLLIPHANT.—This question is so important in its bearings that I think it should be referred to a special committee.

THE PRESIDENT.—The By-laws provide otherwise.

DR. OLLIPHANT.—I would ask if those persons interested in the question will be allowed to go before the Executive Committee and argue the points. I ask for information.

DR. GIHON.—The Executive Committee will refer back the resolution or kill it. It may never come out of the committee, but if it does come back the gentleman may then make any motion he pleases in regard to it.

DR. OLLIPHANT.—I should like to go before the Executive Committee at the time this resolution comes up, to argue some of its points.

DR. HOWARD E. AMES.—Why is this gentleman so much more interested in this matter than the rest of the Association? I cannot see why he should have greater interests involved than the rest of us.

The Secretary read Art. 18 of the By-laws, which provides for the disposal of resolutions.

DR. OLLIPHANT.—I would ask if any person will be allowed to go before the Executive Committee to discuss this question, and who is chairman of the Executive Committee? Will that committee receive arguments on resolutions before returning them to the Association?

THE PRESIDENT.—The Executive Committee will not allow any person to go before it for the purpose of argument.

The first paper read was on "Prevention of Ophthalmic Neonatorum," by Dr. Augustín Chacón. (See page 176.)

DR. ALBERT L. GIHON.—I move that this paper be referred to the Committee on Infantile Diseases, of which Dr. Hewitt is chairman.

Carried.

Paper on "The Collection and Removal of Dead Animals in St. Paul, Minn.," by Dr. Henry F. Hoyt. (See page 115.)

DR. CANTWELL.—I would like to ask Dr. Hoyt if this system includes the disposal of night-soil.

DR. HOYT.—No, sir, the contract does not include that; that is an entirely different matter.

Paper on "Epidemic and Endemic Diseases observed in the Ports of Entry of the Mexican Gulf," by Dr. Luis E. Ruiz. (See page 180.)

Paper on the "Memphis System of Sewerage, as used in Memphis and Other Places," by Col. George E. Waring. (See page 153.)

DR. SOLON MARKS.—I am informed that Dr. Soloman is the representative of Louisiana on the Executive Committee; and as he is absent, I would ask, for information, if it is within the province of the Chair to fill vacancies in that committee?

THE PRESIDENT.—It is not within the province of the Chair to fill vacancies in the Executive Committee. The Constitution provides for the filling of such vacancies.

DR. MARKS.—I would move that the Chair be empowered to fill vacancies in that committee, by absence, death, or otherwise.

THE PRESIDENT.—It is already provided by the Constitution how vacancies shall be filled.

The Secretary read Art. 9 of the Constitution, providing for the filling of vacancies in the Executive Committee.

DR. PETER H. BRYCE.—I move that the report in regard to emigrant ships be deferred until to-morrow morning, to be considered in connection with the other questions in regard to quarantine. Carried.

DR. LICÉAGA.—The interesting excursion to the Drainage Works of the Valley of Mexico will take place the day after to-morrow.

In order that there shall be no difficulty in the distribution of tickets, the Local Committee has made the following arrangement with the President of the Association: the proper invitations have been forwarded to the visiting members from Canada and the United States to the Treasurer of the Association, and this gentleman will distribute them to-morrow. The members are therefore requested to apply to the Treasurer's office, where they will receive their tickets.

As the number of persons who can go to the Drainage Works is lim-

ited, and there are 285 invitations, the company has requested me to inform the members that it is perfectly impossible to carry any larger number.

The railroad by which we will proceed to the Drainage Works is exclusively dedicated to the carriage of material, and does not maintain more than one small locomotive, so that we have calculated that with the members of the Drainage Board and of this Association, we will have about 300 persons, and that is quite as large a number as can be taken.

As I have before said, a limited number of invitations have been sent to the Canadian and North American members, and with respect to the Mexicans, it was arranged that the delegates from the different states of the Union should receive personal tickets, and these will be distributed by Dr. Chavez, between the hours of 12 and 1, at the office of the Supreme Board of Health.

Of the few tickets that remain, I have not cared to make any distribution, but I have handed them over to a committee, composed of Drs. Carmona y Valle, Lavista, Mendizabel, and Marin.

I again notify the members that the horse-cars will start from the main square at 6:30, in the morning of Saturday, 3d.

Adjourned.

FOURTH DAY.

FRIDAY, December 2, 1892.

MORNING SESSION—9 O'CLOCK.

The meeting was called to order by the President at 9 o'clock, in the Chamber of Deputies.

Prayer was offered by Rev. Mr. Brown.

Announcement of the Local Committee of Arrangements:

DR. LICÉAGA.—Our visit to the National Medical Institute ought to have taken place to-day, but not a single person went. I strongly recommend the members to visit this establishment, which is really of importance; the members will be able to visit it this afternoon after concluding the ordinary session.

At mid-day we have an interesting visit to make,—to the School of Fine Arts. I hope the members will not fail to attend.

At half-past eight this evening we have the closing session in the National Theatre, and to-morrow the excursion to the Drainage Works. I strongly recommend punctuality before half-past six in the morning, in the main square.

As I will have no other occasion to speak of this matter of the excursions, I will now inform you of the changes made in the programme for Sunday.

According to the programme, the members of this Association were to be received at four o'clock on Sunday afternoon by the President of the Republic, in the Castle of Chapultepec. All the ladies accompanying the members have expressed their desire to see Mrs. Diaz in that

reception. With great courtesy, this lady has informed us that the wife of the President of the Republic cannot take part in any official acts, in fact, that she has only the standing of the wife of a private individual; but at the same time, wishing to show all attention to our foreign visitors, she has asked me to inform you that she will be happy to receive you on the return from Chapultepec, in her own house, in the Calle de Cadena, No. 8.

Reports from the Executive Committee:

The Secretary cast the ballot of the Association for the election of new members.

The Secretary.—Dr. J. D. Plunket offered the following resolution yesterday, and the Executive Committee recommends its adoption:

Whereas, The subject of hygiene is now taught in the public schools of the United States of America, at the Universities of Pennsylvania and Virginia, at Harvard, Yale, Bowdoin, and other colleges, and at the Naval Academy at Annapolis, Md., and

Whereas, Military Hygiene, as a branch of the general art of war, including the subjects of shelter, heating, ventilation, water-supplies, food, disposal of sewage, and the clothing and physical training of troops, both in peace and in war, should be recognized as a necessary and important part of the curriculum at all medical schools, and

Whereas, This important subject forms no part of the curriculum at the United States Military Academy at West Point, N. Y., therefore be it

Resolved, That a committee of this Association be appointed to urge upon the congress of the United States the advisability of introducing the subjects of Physiology and Hygiene in the course of study at the Military Academy aforesaid.

Adopted.

The Secretary.—The Executive Committee recommend the adoption of the resolution offered yesterday by Dr. Licéaga, as follows:

Whereas, Yellow-fever is one of the scourges which causes many deaths in the localities where it exists endemically, and

Whereas, The disease is a serious obstacle to the social and mercantile relations of the United States and the Republic of Mexico, so they cannot reach the state of intimacy and grandeur so much desired, therefore be it

Resolved, That an international committee of seven, with Dr. Formento as chairman, be appointed, with the object,—

1st. To collect all data relating to yellow-fever along the coasts of the United States and Mexico.

2d. To study the best measures to be adopted to secure the extinction of the fever.

3d. Also to study the most efficacious measures to impede the importation and propagation of the disease in those places which are ordinarily exempt from it.

The committee will appoint from among its members a sub-committee, which will undertake the study of reciprocal defensive measures to be adopted in both republics against all other transmissible diseases.

Adopted.

The Secretary.—The Executive Committee recommends the adoption of the resolution offered by Dr. S. H. Durgin, appended to the report of his committee, as follows:

Whereas, The unprecedented solicitude felt by the American people on the approach of cholera from Europe in 1892, with its attendant interruption of commerce and travel, may be repeated with added terror in 1893, and

WHEREAS, The paramount danger of introducing cholera and other dangerous diseases into this country from the Eastern continent lies with the immigrant, his baggage, and the unfavorable conditions of his voyage; it is therefore

Resolved, That in the opinion of the American Public Health Association, the emigration laws of the United States, Canada, and the Republic of Mexico should be so altered or framed as to provide for the greater safety and welfare of passengers and seamen on shipboard, and the protection of the several countries against the importation of dangerous diseases.

That all emigrants and baggage shall have such scientific treatment before embarkation as to warrant, and be attended by a certificate of, freedom from the power to communicate a dangerous disease.

Adopted.

THE SECRETARY.—The resolution offered by Dr. Bryce yesterday has been considered by the Executive Committee. The resolution as amended reads as follows:

Resolved, That the Committee on Sanitary and Medical Service on Emigrant Ships be continued, and be instructed to draw up a report dealing with the details of such improvements, and report the same at the next meeting of the Association.

Adopted.

THE SECRETARY.—The resolution offered yesterday by Dr. Gihon is recommended by the Executive Committee for adoption, as follows:

Resolved, That in view of the impending danger from cholera in 1893, it is the opinion of the American Public Health Association that a National Health Service should be established in the United States of America, as has been done in the Republic of Mexico, to procure uniformity of action in protecting the sea-coast from invasion by epidemic disease, and to permit international sanitary conference and concert with this object; and this Association respectfully urges, through its President and Secretary, upon the congress of the United States, the imperative necessity for the prompt establishment of such a service, in the interest as well of the United States as of Canada and Mexico.

Resolved, That the Committee on National Health Legislation shall be empowered and directed to communicate to this end with such committees as may be appointed by the senate and house of representatives of the United States to consider this matter.

Resolved, That the Committee on National Health Legislation shall be continued, and enlarged to the number of thirteen.

DR. ALBERT L. GIHON.—This resolution does not look to the interference with any existing system of quarantine. The chief object is to urge upon the national government the adoption of such measures as shall prevent the introduction of this disease into the United States. Should the disease reach our shores, then the several parts of the country, as now, must disinfect, isolate, and do whatever they can to restrict it; but the object of this resolution is to prevent the invasion of our country by the disease. We have seen from Dr. Swearingen's report that it was impossible for him to consult with the Mexican government in the matter of small-pox; so his efforts were directed to keeping it out of Texas, and the object of this resolution is to keep cholera out of the United States. There is no attempt to go into details, and there is nothing looking to the abrogation of any existing quarantine system. It is simply to procure uniformity of action to prevent the introduction of disease. The committee should be enlarged, so that all parts of the country may be represented.

DR. BUSHROD W. JAMES.—I desire to offer as an amendment, that the

committee be enlarged to five from each of the countries of the United States, Canada, and the Republic of Mexico, in order that we may have uniformity in this matter. We all know that as soon as an epidemic has reached our country, we have an internal quarantine that will prevent the spread of the epidemic from one country to another. This is a very important question to the commercial interests of the seaports, and the committee should give especial attention to the consideration of measures to prevent the spread of epidemics from one country to another. We should consider external quarantine as well as internal quarantine. We must prevent infected people from coming to our shores; but we should also prevent our own infected people from invading other countries. Had such measures been adopted in the East, cholera would not have reached Russia. I should like to see in this resolution, measures adopted that would apply both to internal and external quarantine of these countries.

Dr. William Bailey.—I approve the purpose of the resolution, but take some exception to the explanation offered by Dr. Gihon. I think this Association should not undertake to confer any rights upon the United States government; we should simply recommend.

Dr. Albert L. Gihon.—I used the words "respectfully urges."

Dr. Maurice Perkins.—I wish to refer the members to the article of the Constitution which reserves to the states all police powers.

Dr. John T. Nagle.—I think it would be well to state, in an extra clause in the resolution, that it is not intended to interfere in any way with quarantine regulations.

Dr. Albert L. Gihon.—I have already stated, and it is understood, that the resolution has nothing whatever to do with internal quarantine regulations or sanitary rules. It simply urges upon the United States government the adoption of such measures as shall prevent this disease from coming to our shores. The different states may take such action as they please after the disease is here; but we want some action taken to prevent the disease from coming here. Reference has been made to international arrangements, but this has nothing to do with this matter. Each state can adopt such measures as it thinks necessary to protect itself.

Dr. Olliphant.—I understand that the United States government is to control the introduction of cholera, but after it is once here each state is to act for itself and adopt such measures as it may deem necessary for its own protection. I would like to ask if the United States government would have the control of the introduction of cholera from the Mississippi river?

Dr. Albert L. Gihon.—If a ship should come to the United States with cholera on board, I think the government should have the power to send that ship back again, to prevent the introduction of the disease. After the disease is introduced the states must deal with it, but the United States should have power to prevent its introduction. I do not propose to interfere with any state arrangements whatever.

Dr. Henry B. Baker.—I support the resolution, but object to the explanation. We have quarantine stations at only a very few ports of the United States that are competent. We have one at New Orleans, at Boston, and at New York, but we find none at other places.

It would be possible for cholera to enter any of these unprotected ports. We want the United States government to protect us where we need protection, at all unprotected ports along the whole length of the Atlantic coast.

Dr. Solon Marks.—I move as an amendment to the resolution, that it be further resolved that nothing in this resolution conveys the idea, or endorses the principle, of federal interference with the sovereign rights of a state to control its quarantine regulations.

Dr. Peter H. Bryce.—If a committee is appointed to present the matter to congress, they can interpret the resolution for themselves. The amendment is one that I cannot indorse, and I favor the original resolution, as offered by Dr. Gihon.

Dr. Otero.—All the Mexican members are perfectly in accord with the resolution which has been moved, because, from what has been said in English, we have understood that some of the foreign members of this meeting have, to a certain extent, opposed the resolution which has been moved and read in both languages. They say that the states are free and sovereign, both in the United States and in Mexico, and therefore it would not be convenient to propose a general law for the whole of the states, seeing that they are independent of each other in their domestic legislation.

Such liberty appears to me a complete misunderstanding of what liberty really is. A celebrated man once said that liberty terminates where the rights of others commence; and the sound man very clearly has a right to prohibit the sick man from contaminating him with his disease. I am, therefore, strongly of the opinion that these arguments are open to attack.

In one of the splendid speeches that we have heard from Dr. Licéaga he says as follows: "With regard to its sanitary laws Mexico is only one nation, and if the states are free with respect to their domestic legislation, they really form only one community with respect to their interests."

For my part I say, that not only Mexico, but the North American nation and humanity in general, form one sole community in questions of disease, whether these be moral, intellectual, or physical, and the tendency of this Association is exactly arranged to propagate the science of hygiene, as far as it is possible to do so on the entire continent of America. To oppose such an intention shows a great want of comprehension of the laws of hygiene.

I therefore must express my hope, that all will unite and vote in favor of this motion, bearing in mind that we are all brothers and must unite to combat or prevent all the diseases that might be propagated in the American continent; and I believe that we ought to do this, not only for the sake of Americans in general, but also for the sake of humanity.

DR. SWEARINGEN.—I move that we table all amendments and take the original resolution, as offered by Dr. Gihon.

Carried.

DR. HENRY B. BAKER.—I move the adoption of Dr. Gihon's resolution.

Resolution adopted.

Report of the Committee on National Health Legislation, Dr. Henry P. Walcott, chairman. (See page 409.)

DR. HOWARD E. AMES.—Before this report is adopted, I think it should be somewhat modified, because as it now reads it is too dictatorial. As it is presented, it dictates to the government what we should simply recommend.

THE PRESIDENT.—It is simply a recommendation on sanitary matters.

DR. YANDELL.—I do not suppose that any gentleman in the house who has not read these resolutions, understands the purport of them. We have just acted on the question of national quarantine, and have agreed on Dr. Gihon's resolution, and we are to have a committee to consider these matters, and I therefore move that the report be filed, and it will be for the thirteen members of the committee to consider and act upon the resolutions. We cannot intelligently act upon them from having heard them read once.

The report of the committee was adopted.

DR. HENRY B. BAKER.—Will this report be referred to the committee of thirteen?

THE PRESIDENT.—Yes.

THE SECRETARY.—I have the preliminary report of the Committee on Protective Inoculations in Infectious Diseases.

Report read by title and referred to the Committee on Publication.

The first paper presented was on "Typhoid Fever," by Dr. J. H. Kellogg.

(See page 26.)

DR. HENRY B. BAKER.—I wish to give notice, that in view of the impending danger from cholera, and the uncertainty of national legislation, it is desired by the members of the International Conference of State Boards of Health to have a meeting here at the Preparatory School of Medicine, after the meeting of the Advisory Council. I would ask that at that meeting the representatives of the state boards of health be present; also the quarantine officers of the several countries.

Dr. John Griffin, of Brooklyn, N. Y., offered the following resolution:

WHEREAS, The American Public Health Association, at its meeting held in the City of Mexico, in December, 1892, for the purpose of discussing matters relating to the public health and the best manner of preventing disease, and

WHEREAS, This country has been seriously menaced by invasion of Asiatic cholera during the past summer and fall, particularly during that period between August 31st and October 21st, 1892, when nine hundred and ninety-seven vessels from foreign and domestic ports, carrying eighty thousand and seventy-seven persons, passed through the quarantine of the port of New York, all having been personally examined by Dr. William T. Jenkins, the Health Officer of the port of New York, and his assistant, and

WHEREAS, through the vigilance, energy, zeal, and efficiency of the investigations made by these officials, 266 cases of Asiatic cholera were discovered to have occurred on vessels coming from infected ports, and of this number 96 terminated fatally, 76 at sea and 20 at the Quarantine Hospital at Swinburne island, and 24 died on board vessels in the port of New York; but in no instance was there a case of Asiatic cholera among any of this large number of persons that passed through quarantine. Therefore, be it

Resolved, That this Association avails itself of this opportunity to express its high appreciation of the successful effort of Dr. W. T. Jenkins, Health Officer of the port of New York, in preventing the introduction of Asiatic cholera.

DR. JOHN NAGLE.—I beg to inform the Mexican doctors who are present, and who may not have understood the resolution that is presented, that I came from the state of New York.

We have here a Dr. Jenkins of whom we feel very proud, because he prevented the development of cholera in New York when we were exposed to that disease. That gentlemen is now sitting in his seat and honoring us with his presence.

It is due to Dr. Jenkins that the cholera did not obtain a footing in the United States, through the port and state of New York, which contains more than six millions of inhabitants.

I suppose that the Mexicans here present know more of the laws of their own country than of a foreign country, and the Mexicans have a right to make their laws to suit their own pleasure, as they will naturally be better arranged than if made from a distance of one thousand or more miles.

I believe that this is the best way to proceed, because it is well to bear in mind the Spanish proverb which says that "A madman knows more in his own house than a sane man in somebody else's house." For this reason I conclude my remarks by saying,— *Viva Mexico.*

DR. GIHON.—I wish to say to my friends the Mexicans, that if there were a Dr. Jenkins in every port, there would be no necessity for the resolution which has been presented.

DR. TEJEDA.—The time at the disposal of this meeting being limited, and there being a good deal of work yet to attend to, I move that the resolution be put to a vote.

THE PRESIDENT.—Under the standing rules of the Association, this resolution must be referred to the Executive Committee previous to any action on it by the Association.

DR. BENJAMIN LEE offered a resolution requesting the Superior Board of Health of Mexico to prepare a memorial on the subject of typhus fever, now raging in certain towns of Mexico. Resolution referred to the Executive Committee without discussion.

Paper on "Contributions to the Bacteriological Study of the Drinking Waters of the City of Mexico," by Dr. José Ramirez, and Dr. Manuel Toussaint. (See page 57.)

DR. MONJARAS.—I desire to make a few remarks on this important question of the bacteriological study of water, with the object of demonstrating, in support of the arguments of Dr. Ramirez, that on account of a slight epidemic of cholera nostras, which we had in the capital of San

Luis Potosi, I also undertook a bacteriological study of the waters of that city, with the result that I ascertained, in a very clear manner, that the water had very little influence on the production and development of that epidemic.

At the same time that I entered on this bacteriological study, I took decided steps to collect all the rotten fruit which was exposed for sale in the public markets, and at the same time, to remove from the public eating-houses which are to be found in that city, all those animal substances that easily enter into decomposition and which might escape the vigilance of the inspectors, and being sold to the customers or frequenters of these eating-houses, would most likely result in attacks of cholera nostras.

With reference to the analysis of the waters, I must inform you that I was able to isolate a micro-organism which was taken from fæcal matter of an individual who had been attacked by cholera, and I was also able, by means of an analysis of the well-waters which supply the city, to isolate another organism, which was exactly similar in its physiological character to that which I obtained from the intestines of that patient.

I therefore believe, that without denying the influence of the new organism found in infectious diseases, principally in cholera nostras,—without denying for a moment that these organisms may be swarming in the waters, and thereby may produce the disease, I agree with what has been said by Dr. Ramirez, that the principal cause of these diseases is the ingestion of decomposed substances into the human organism.

I may state that the method which I have employed for the study of these waters is that employed by Michell, and which is a little different from that employed by Dr. Ramirez. The Michell process consists in dividing the liquid in broth by means of drops, sub-dividing the water, and subjecting it, for the space of a month, to a constant temperature of 33° in an adequate stove.

This innovation has been introduced, because experience has shown that 50 per cent. of the bacteria are lost when the analysis lasts 15 days; when it lasts 25 days, 25 per cent. are lost; and lastly, if a perfect analysis is obtained, not one bacteria is lost during a full month.

By employing the gelatine process we find two difficulties,—in the first place, that it cannot be subjected to a high temperature, because it liquefies; and in the second place, because it must be employed in and leaves, so to speak, the other bacteria undeveloped which have to come later on.

For this reason, it is clear that the best process of analyzing water is that which allows us to obtain a complete development of all the organisms that might be contained in that water.

Dr. Gaviño.—I regret that Dr. Monjaras should have wasted several minutes of our time on a question that is perfectly explained in bacteriology.

I only rise to make a small explanation. With respect to the work of Dr. Ramirez, we must note that the European bacteria are very differ-

ent from the Mexican. There are no similar species, and the chromogenous microbes lose their chromogenous powers at an elevation of a little over 3,000 metres.

The Koch bacillus can be confounded with that which is found in the waters of Mexico; but there is this difference between them, that the Mexican has a length of two micros, thirty-three millonesimas; and lastly we have in the soft waters, colonies similar to those in the hard waters, of which Dr. Ramirez has spoken.

Paper on the "Disposal of Garbage in the City of Providence, R. I," by Dr. Charles V. Chapin. (See page 259.)

Paper on "Importance of Hygiene and Advantages of the Creation of a Health Department," by Dr. Manuel Septién.

AFTERNOON SESSION—3 O'CLOCK.

The meeting was called to order at 3 o'clock in the National Preparatory School of Medicine, Dr. Orvañanos in the chair.

The first paper presented was on "A Few General Remarks Regarding Yellow-fever in the State of Tabasco." By Dr. Adolfo Castañares. (See page 217.)

Paper on "The Extension of the Use of Live Steam to Municipal and Household Disinfection," by Dr. George Homan. (See page 149.)

Paper on "The Intervention of the Federal Power in Sanitary Matters," by José M. Gamboa. (See page 125.)

Paper entitled "To what Extent Can Mexican Typhus be Considered a Communicable Disease?" by Dr. Jesus Chico. (See page 130.)

DR. MARMOLEJO.—The subject of the paper to which we have just listened is of so serious a character that it encourages me to raise my voice for a few moments, with the object of exciting the well known patriotism of my Mexican colleagues and the learning and philanthropy of our distinguished guests, in the hope that they will give it their most serious consideration.

Dr. Chico's paper contains a question, the answer to which is of the most urgent necessity, under the present circumstances, to many towns of the Republic which are cruelly afflicted with the scourge of typhus.

The capital of the state of Guanajuato, where Dr. Chico practises medicine, sees with the greatest terror a daily increase in the progress of this epidemic, which is spreading to all classes of society.

Zacatecas has seen a lamentable diminution of a number of its physicians, who have succumbed to this dread epidemic, without speaking of the innumerable victims amongst the general public. It is useless for me to cite any further examples, as you all know perfectly well that the generalization of this calamity is assuming gigantic proportions.

Desiring the ordinary sessions of this hygienic Association should be closed with a page that would be memorable for Mexico, and desiring that the contingent of all talent, both from this metropolis as well as from

the other states, whether foreign or national, which are represented in this congress of science, should contribute to the solution of this important question, I have the honor to propose to this Association, that with respect to the learned paper contributed by my companion, Dr. Chico, they should all be requested to answer,—putting on one side all the doctrines that they profess, and conscientiously holding to the results of their professional practice,—whether they consider typhus an infecto-contagious disease.

Dr. Tejeda.—I have listened with great pleasure to the paper read by Dr. Chico, and although I agree with most of his observations, I would like to make a few remarks, which are the result of my own experience, although slight, of bacteriology and of the technique of this disease. With regard to the first point, I beg leave to observe that this disease, by its character, its progress, its epidemic or endemic condition, and in one word, from the full table of symptoms which it presents, is generally of an infectious character. It is very certain that up to the present date our bacteriological studies have not brought to our knowledge the pathogenic germ of the disease; but it pertains to the same genus of other diseases whose germs are perfectly known to science.

Judging, therefore, from its progress, and from the manner in which it presents itself, I am of opinion that this disease is infectious, and in that case, we must admit that it is contagious. I cannot say, as some do, that it is perfectly contagious, because we know that some diseases are eminently contagious whilst others are only slightly so; but typhus pertains to the same family as typhoid fever, and in France they isolate persons affected with this disease, and find that precaution very useful in avoiding the propagation of the evil. In treating children who have been attacked with this fever, I have had occasion to impose rules, in order that antiseptic precautions should be taken in visiting the patient.

The same does not happen with diphtheria, measles, small-pox, or scarlatina, and other diseases of the same class, in which, as soon as the diagnosis shows the patient to be under their influence, he is at once isolated in the best manner possible. For this reason, I believe that if the disease is not eminently contagious it is so to a slight degree.

Dr. Chico argues that physicians very seldom fall victims to this contagion. Unhappily I have observed the contrary in practice, and I could cite a very large number of cases, but I confine myself for the moment to reminding the meeting that it was this disease of typhus which carried off my late Professor Ortega, Dr. Muñoz, the late lamented Brasetti, and many others whom my colleagues will remember.

Dr. Chico.—I will confine myself to asking that the meeting observe that I, who am systematically opposed to all dogmatic propositions, and who consider that the man who takes an extreme view is either in error or very near to it, present this proposition: That typhus is rather an infectious than a contagious disease,—that is to say, that I am far from asserting that typhus is an infectious and not a contagious disease.

Dr. Tejeda will allow me to make a few remarks, informing him that

this idea which I have just explained was not searched for by myself, but rather that the idea was forced upon me by my observations and practice.

Dr. Tejeda cites several cases of contagion, but I should like to ask him in what manner it was proved that these really were cases of contagion? Was the contagion only by contact? In his turn, he will ask me, How did you know that the contact was not contagious? and I answer,—I have frequently thought, and have had the opinion suggested to me, that the patient having been in contact with a case of typhus, he had thus taken the disease and proved the contagion.

But my reasons for deciding that there was no contagion, are as follows: A man falls sick with typhus, and some person attends to him during his sickness; he also contracts the fever, and goes to his own house, where he is attended by other persons, with those antiseptic precautions which we may call of the domestic class, and which consist of sprinkling carbolic acid or chloride in a general way about the house, and even these precautions are not always taken, and nevertheless there is no contagion. I am disposed to consider this a question of criterion, to the full extent of the word.

From the cases which I have observed, I have come to believe that the body of the patient is not the source of the evil, and I should like Dr. Tejeda to say how many persons took the contagion from our esteemed Professor Dr. Ortega. Let him prove that these persons carried the germ of the evil on their own bodies; and if not, I will still persist in my opinion that the patient does not carry the germ in his body, and therefore avoiding all extremes, I still must say that the cases cited by Dr. Tejeda do not prove that typhus is contagious, but rather prove my argument with respect to infection.

Dr. Lomas.—I believe that in Guanajuato, Zacatecas, and San Luis Potosi, where it is difficult to clean out the closets for want of water, it would be very difficult for the resident physicians to determine whether the cases of typhus which they observe in their practice are exclusively caused by infection or exclusively by contagion; but in those districts where typhus is not spontaneous, it is easy to know with certainty whence it comes and how it is propagated I have observed cases, like that of Dr. Calderon, who contracted the fever in Cuernavaca by attending a patient who carried it with him to that city from Mexico. This case, like many others which I could cite to Dr. Chico, perfectly proves the contagious character of typhus fever.

Dr. Macias.—I believe that the greater part of the members here present will agree with me that we are discussing a question of the greatest importance and practical utility, and for this reason we ought to search for information that will throw a light on this obscure point of science. Holding this opinion, I would suggest that Dr. Carmona y Valle, who has been the master of many of the physicians present, should give his valuable opinion on this subject.

Dr. C. O. Probst, secretary of the Advisory Council, presented the following report:

The Advisory Council recommends that the city of Chicago be selected as the place of meeting for the association in 1893.

Officers of the Association for the ensuing year are nominated, as follows:

For President.

Dr. Samuel H. Durgin, Boston, Mass.

For First Vice-President.

Dr. Eduardo Liceaga, Mexico, Mex.

For Second Vice-President.

Dr. Emmanuel Persillier Lachapelle, Montreal, Can.

For Secretary.

Dr. Irving A. Watson, Concord, N. H.

For Treasurer.

Dr. Henry D. Holton, Brattleboro, Vt.

For Members of the Executive Committee.

Drs. James T. Reeve, Appleton, Wis.; Eduardo Liceaga, Mexico, Mex.; Pinckney Thompson, Henderson, Ky.

Dr. Albert L. Gihon.—I move that the Secretary cast the vote of the Association for the election of officers for the ensuing year.

Adopted, and the Secretary cast the ballot of the Association for the following officers for the year 1892–'93: President, Dr. S. H. Durgin, Boston, Mass.; Vice-President, Dr. Eduardo Licéaga, Mexico, Mex.; Second Vice-President, Dr. E. P. Lachapelle, Quebec; Secretary, Dr. Irving A. Watson, Concord, N. H.; Treasurer, Dr. Henry D. Holton, Brattleboro, Vt.

Dr. S. H. Durgin.—I am deeply grateful to you, gentlemen of the Association, for the very high compliment which you have seen fit to bestow upon me by making me your next president. I know of no more honorable position to which any gentleman might aspire, and none in which I could take more pride in trying to fill. It will be my pleasure and duty to serve the Association to the best of my ability.

Adjourned.

EVENING SESSION, DECEMBER 2.

[Held in the National Theatre.]

Dr. Gregorio Mendizabal spoke on the progress and the importance of hygiene, bringing forward the utility and important services which in this matter are rendered by the American Association of Public Health.

Dr. Jose Peon Contreras then read a poem appropriate to the occasion, and Dr. Juan Jose Ramirez de Arellano pronounced the closing discourse to the members of the Association, as follows:

Mr. President and Gentlemen: On me has fallen the sad task of bidding you farewell, of announcing that our brief and pleasant meetings have come to an end, and of pronouncing that sad, pathetic word of my own language, "*Adios !*"

Unfortunately, everything in this world is transitory—everything arrives, and everything passes—"the longed for to-morrow" flies by and turns into the "yesterday," often of painful memory—the present rushes along in a mad race, burying itself in the past, and the uncertain future promptly arrives,—to pass by in its turn, leaving as traces of its passage a few bright or darksome images.

Happily, in the continual and contrary movements that make up our lives, in the agitated and tempestuous sea of life, in which the waves come and go or are broken one over the other, we find a constant and immutable law,—the law of compensations.

It is through this wise and consolatory law, that rules the destinies of the real and physical as well as the moral and psychological world, that we always find a consolation for every sorrow, a balm for every pain, and a remedy for every evil.

It is for this reason, that in spite of the pain I feel in bidding farewell to this distinguished assembly, I have a deep and grateful recollection of these past days; days of agitation and enthusiasm, consecrated to study and honest work, to the advancement of science, and the good of humanity.

And I have good reason to feel satisfied with these recollections. For the first time in the history of my beloved country, she has witnessed the grandly sublime spectacle of the arrival from all parts of her own territory, and from her two northern neighbors, of hundreds of illustrious and learned men, who, like primitive Christians or the more modern pilgrims, have traversed mountains and deserts or sailed over the seas, to answer the call of science, and to render it homage in this temporary shrine, without personal interest, with single mindedness, and with a sacred and noble end,—the advancement of science and the good of humanity.

It cannot but be a grateful recollection to myself, and to all my countrymen, to have seen in our midst this assembly of genuine representatives of science—soldiers in that great army whose holy standard carries the motto of "Excelsior." Like the sacred vestals of old, you keep alive the sacred fire on the altar of science, scrupulously observing the ancient maxim of *altere flamam;* with your assiduous and constant study, with your perseverance and unflagging industry, you have made yourselves its apostles, meriting and receiving the respect and love of the people, for whose well-being and health you sacrifice yourselves. As our own immortal poet Acuña has so happily expressed it, "Science, like God, has its worship—and, like God, has its Saints."

In future years, when history, with its severe and impartial judgment, collects the facts and saves your names from oblivion by writing them with imperishable characters in its pages, you will obtain the just recompense for your great and useful labors.

For the present, the only thing you can carry with you on leaving my beautiful and hospitable country, to return to the warmth of your own firesides, will be the sweet satisfaction that every noble heart feels in the performance of good deeds. You will also carry with you the glory that always surrounds the learned man who works and studies for the life and well-being of his fellow-men.

Gentlemen, history relates, that in remote times a fearful tyrant existed, who, unable to satisfy his thirst for blood and hatred of humanity, in one of his delirious rages expressed his brutal feelings by saying: "I would that the human race could be condensed into one man, so that at one blow I could decapitate mankind in general." Contrary to this hated monarch, I would desire at this moment, when I am fulfilling my difficult and sad task,—in which I have to bid you farewell,—I would desire, I say, that all your hands could for a moment be united in one, so that I could give it cordial and loving pressure that would serve to show my esteem.

But since I cannot realize this brotherly wish, permit me at least to express, in a few simple but sincere words, the sentiments of affection and esteem that fill the hearts of my countrymen and myself at this moment.

I can assure the illustrious representatives of the American Association of Public Health, that when they leave this country they will carry with them the frank and sincere friendship of the Mexican members; and that whether they are in our company or in their distant homes, we will always remember them with esteem and affection.

Medical Director ALBERT L. GIHON, U. S. Navy, then spoke as follows in Spanish:

Mr. President, Ladies and Gentlemen: The agreeable duty has been assigned me to proffer the thanks of this Association to the following —to wit:

The President of the Republic.

The Archbishop of Mexico.

The Ministers of State and of Justice.

The Governor of the Federal District.

The Chamber of Deputies.

The Honorable Ayuntamiento of the Capital.

The Junta Directiva of the Drainage-Works.

The Representatives of the Press.

The Jockey Club.

The Director of the Preparatory School.

The Managers of the Railroads.

Jeña Cerdan, Proprietor of the National Theater.

The Directors of Schools and Hospitals.

The Mexican and American ladies, who have shown attention to the visiting ladies.

The members of the Local and Reception Committees.

The families who have loaned their carriages, and all those who have assisted in entertaining the visiting members.

Señor José Carmona, and Señores Licéaga, Lavista, Orvañanos y Gayol, who have received members of the Association in their houses.

Ladies and Gentlemen of the city of Mexico: An ex-president is a defunct one, and for that reason I ought to remain silent. Nevertheless, even the dead, on this occasion, cannot be insensible to the amiable welcome, which they, as well as the living, have received in this city, as everywhere else in the Republic of Mexico. On this account, I desire to express, and I regret that I cannot express it as I ought in your beautiful language, our appreciation of your goodness, your generosity, and your hospitality. May you live many years—happy years and healthy years—for if they shall be healthy, as we seek to make them, they will be happy, and long, and full of prosperity. We congratulate ourselves that we have come to Mexico. It has been a lesson for us that we can never forget. We have learned to know Mexico and the Mexicans, and from this time forth, we shall feel that we all really belong to the *United* States, be they American or Mexican.

Dr. F. Montizambert.—*Mr. President, Ladies and Gentlemen of Mexico:* Dr. Gihon, in the beautiful language of the country, has returned thanks for the Association as a whole. May I be permitted now, as a representative of the Dominion of Canada, to express, in my own name and for my fellow Canadian delegates, our very sincere appreciation of the extreme courtesy and kindness which has been extended to us. I was about to say—since our arrival in your city. But, indeed, it began long before that. While we were still hundreds of miles away, we were met by kindly gentlemen who had so thoughtfully prepared that welcome for us, and who made everything in connection with our arrival smooth and easy and pleasant for us. From that time until now, every day, indeed I may say every moment, has been so filled with offers of hospitality and kindness that our only regret has been that we could not show our appreciation by more fully availing ourselves of them. Indeed, nothing but a strong sense of duty has enabled us to resist these pleasant temptations, and has prevented our entirely abandoning, for their sake, the work of the Association.

This Association as you know, now bears on its certificates of membership, the coat-of-arms of the United States, of Canada, and of Mexico, Upon our opening night, through the courtesy of the Local Committee of Arrangements, the band played the national hymns of the three countries. And their flags were gracefully and lovingly entwined amidst the decorations. We will all, I am confident, unite in the trust that this is emblematical and symbolical of the close union of the three countries in furthering and carrying out the great object of this Association, the prevention of disease, and the raising of the standard of the public health, throughout the length and breadth of this great continent.

Allow me again to express our grateful and heartfelt appreciation of your great and uniform kindness, and to tender you the assurance of the warm and kindly recollections we shall ever retain and cherish of our visit to your beautiful Mexico.

Dr. Licéaga.—I move that a vote of thanks be given to the officers of the Association, who have held office during the past year, and especially to Dr. Formento.

Motion read.

Dr. Gihon.—*Gentlemen:* With the permission of the President of the Association, I, as President of the Section on Hygiene, Climatology, and Demography of the First Pan-American Medical Congress, invite you all to be present at that congress in the city of Washington, on the 5th of September, 1893.

We expect delegations from all the different countries of North, Central, and South America, from the West India islands, and the kingdom of Hawaii.

As two hundred American doctors have come from the North, we expect that at least five hundred Central and South American and Mexican doctors will visit us in Washington.

Dr. Formento.—In closing the session of the American Association of Public Health, I do not bid you farewell, but *au revoir*, as we shall all see each other again in Chicago.

Adjourned to meet in Chicago, October 9–14, 1893.

CONSTITUTION

OF THE

AMERICAN PUBLIC HEALTH ASSOCIATION.

TITLE.

I. This Association shall be called "THE AMERICAN PUBLIC HEALTH ASSOCIATION."

OBJECTS.

II. The objects of this Association shall be the advancement of sanitary science, and the promotion of organizations and measures for the practical application of public hygiene.

MEMBERS.

III. The members of this Association shall be known as Active and Associate. The Executive Committee shall determine for which class a candidate shall be proposed. The *Active* members shall constitute the permanent body of the Association, subject to the provisions of the constitution as to continuance in membership. They shall be elected with special reference to their acknowledged interest in or devotion to sanitary studies and allied science, and to the practical application of the same. The *Associate* members shall be elected with special reference to their general interest only in sanitary science, and shall have all the privileges and publications of the Association, but shall not be entitled to vote.

Delegates fron national, state, provincial, and municipal boards of health, organized sanitary associations, and the army, navy, and marine hospital service, shall be entitled to be enrolled as active members upon presentation of their credentials to the Executive Committee. Members, not delegates from such bodies, shall be elected as follows:

Each candidate for admission shall first be proposed to the Executive Committee, in writing (which may be done at any time), with a statement of the business or profession and special qualifications of the person so proposed. On recommendation of a majority of the committee, and on receiving a vote of two thirds of the members present at the regular meeting, the candidate shall be declared duly elected a member of the Association. The annual fee of membership in either class shall be five dollars.

OFFICERS.

IV. The officers shall be a President, a First and Second Vice-President, a Secretary, and a Treasurer.

All the officers shall be elected by ballot, annually, except the Secretary, who shall be elected for a term of three years.

PRESIDING OFFICER.

V. The President, or in his absence one of the Vice-Presidents, or in their absence a chairman *pro tempore*, shall preside at all meetings of the Association. He shall preserve order, and shall decide all questions of order, subject to appeal to the Association. He shall also appoint all committees authorized by the Association, unless otherwise specially ordered.

SECRETARY.

VI. The Secretary shall have charge of the correspondence and records of the Association; and he shall also perform the duties of Librarian. He, together with the presiding officer, shall certify all acts of the Association. He shall, under the direction of the Executive Committee, give due notice of the time and place of all meetings of the Association, and attend the same. He shall keep fair and accurate records of all the proceedings and orders of the Association; and shall give notice to the several officers, and to the Executive and other committees, of all votes, orders, resolves, and proceedings of the Association, affecting them or appertaining to their respective duties.

TREASURER.

VII. The Treasurer shall collect and take charge of the funds and securities of the Association. Out of these funds he shall pay such sums only as may be ordered by the Association, or by the Executive Committee. He shall keep a true account of his receipts and payments, and at each annual meeting render the same to the Association, when a committee shall be appointed to audit his accounts. If, from the annual report of the Treasurer, there shall appear to be a balance against the treasury, no appropriation of money shall be made for any object but the necessary current expenses of the Association, until such balance shall be paid.

STANDING COMMITTEES.

VIII. There shall be the following standing committees: (1) The Executive Committee, (2) the Advisory Council, (3) the Committee on Publication.

EXECUTIVE COMMITTEE.

IX. The Executive Committee shall consist (1) of the President, First Vice-President, Second Vice-President, Secretary, and Treasurer; (2) of six active members, of whom three shall be elected annually by ballot, to serve two years, and who shall be ineligible to reëlection for a second successive term; and (3) of the ex-Presidents of the Association.

It shall be the duty of the Executive Committee to consider and recommend plans for promoting the objects of the Association, to authorize the disbursement and expenditure of unappropriated moneys in the treasury for the payment of current expenses; to consider all applications for membership, and, at the regular meetings, report the names of such candidates as a majority shall approve; and, generally, to superintend the interests of the Association and execute all such duties as may, from time to time, be committed to them by the Association. At least one month preceding the annual meeting of the Association, the Executive Committee shall cause to be issued to members a notice of such meeting, and they are authorized to publish the same in medical, scientific, and other periodicals, but without expense to the Association; and such notice shall contain the order of business to be followed at said meeting, and, briefly, the subjects to be presented and the special points of discussion.

ADVISORY COUNCIL.

X. The Advisory Council shall consist of one member from each state, territory, and district, the army, navy, and marine hospital service, the Dominion of Canada, and each of the Provinces, the Republic of Mexico and each of the Mexican states, who shall be appointed by the President on the last day of each session, and who, besides acting as nominating committee of officers for the ensuing year, to be announced at such time as the Executive Committee may appoint, shall consider such questions and make such recommendations to the Association as shall best secure the objects of the Association. They shall at their first meeting elect from their own number a Secretary, whose record of their proceedings shall be made part of the records of the Association.

COMMITTEE ON PUBLICATION.

XI. The Committee on Publication shall consist of the Secretary and two active members, selected by the Executive Committee, who shall contract for, arrange, and publish, under authority of the Executive Committee, the proceedings of the Association, including such papers as have been examined and approved by the Executive Committee, or which have been submitted to them by the latter for their discretionary action.

REPORTS AND PAPERS.

XII. All committees, and all members preparing scientific reports of papers to be laid before the Association at its annual meetings, must give, in writing, the title of such reports or papers, the time to be occupied in reading them, and an abstract of their contents, to the Executive Committee, at least one week preceding the date of such meeting, to secure their announcement in the order of business.

MEETINGS.

XIII. The time and place of each annual meeting shall be fixed at the preceding annual meeting, but may be changed by the Executive Committee for reasons that shall be specified in the announcement of the meeting. Special meetings may be called, at any time or place, by concurrence of two thirds of the Executive Committee. There shall be no election of officers, or change of By-Laws, or appropriation of money to exceed the amount at that time in the treasury, at such special meeting, except by a vote of a majority of all the members of the Association. Whenever a special meeting is to be held, at least one month's notice shall, if possible, be given by circular to all the members, together with the order of business.

QUORUM.

XIV. At the annual meeting nine members shall constitute a quorum for the election of officers, a change of the constitution, the election of members, and the appropriation of moneys.

ORDER OF BUSINESS.

XV. The order of business at all meetings of the Association shall be fixed by the Executive Committee, and such order must be completed before any other business is introduced, except such order of business is suspended by a vote of four fifths present.

ALTERATION OF CONSTITUTION.

XVI. No alteration in the constitution of the Association shall be made, except at an annual meeting, or unless such alteration shall have been proposed at a previous meeting, and entered on the minutes with the name of the member proposing the same, and shall be adopted by a vote of two thirds of the members present.

BY-LAWS OF THE EXECUTIVE COMMITTEE.

QUORUM.

1. Five members shall constitute a quorum for the transaction of such business as may come before the committee.

MEMBERS RESTRICTED.

2. No elective member of the Executive Committee shall be at the same time a member of the Advisory Council, if there is another member of the Association from his state or service.

PARLIAMENTARY USAGE.

3. Cushing's Law and Practice of Legislative Assemblies shall be the guide of parliamentary practice until otherwise ordered.

PAPERS.

4. All papers presented to the Association must be either printed, typewritten, or in plain handwriting, and be in the hands of the Secretary at least twenty days prior to the annual meeting, to insure their critical examination as to their fulfilling the requirements of the Association.

5. If any paper is too late for critical examination, said paper may be so far passed upon by the Executive Committee as to allow its reading, but such paper shall be subject to publication or non-publication, as the Executive Committee deem expedient.

6. All papers accepted by the Association, whether read in full, by abstract, by title, or filed, shall be delivered to the Secretary as soon as thus disposed of, as the exclusive property of the Association. Any paper presented to this Association and accepted by it, shall be refused publication in the Transactions of the Association, if it be published, in whole or in part, by permission or assent of its author, in any manner prior to the publication of the volume of Transactions, unless written consent is obtained from the Publication Committee.

7. Day papers shall be limited to twenty minutes, and evening papers to thirty minutes, each.

DISCUSSION OF PAPERS.

8. After the leading papers on each subject, as indicated by the Executive Committee, have been read, discussion shall follow, and be confined strictly to the subject of these papers; and each speaker shall be limited to ten minutes, and shall not speak a second time until after every other member who desires to be heard, and then only for five minutes, except by unanimous consent.

9. The Chair shall notify gentlemen who desire to speak to send up their names, and they shall be called on in the order sent up; and he may, at his discretion, limit the time of speaking to five instead of ten minutes, if in his judgment it may become necessary to do so in order to allow each one on the list an opportunity to be heard.

PUBLICATION COMMITTEE.

10. The Committee on Publication, charged with the duties of selecting and printing the papers and Transactions of the Association, shall consist of three active members of the Association, and of whom one shall be the Secretary, appointed by the Executive Committee during the session of the Association, and selected with reference to their facilities of meeting.

11. All papers read by title, and others not definitely passed upon by the Executive Committee, shall be referred to the Publication Committee for critical examination; and said committee is authorized to reject such papers as in its judgment are not worthy of publication, and to omit such others as cannot be included within the limits of the annual volume.

12. The Publication Committee shall procure a copyright on the Transactions in the name of the Association, and the committee shall have full charge of the publication of the Transactions.

APPLICATION FOR MEMBERSHIP.

13. All applications for membership must be made upon the application blank of the Association.

14. Persons not members, having prepared papers to be presented at the meetings of the Association, shall be proposed for membership at the first business meeting of the Association.

EXPENDITURES.

15. All bills connected with the publication of the Transactions shall, upon the approval of the chairman of the Publication Committee and the Secretary, be signed by the President of the Association, and paid by check of the Treasurer directly to the party concerned; and the President shall not approve any bill, relating either to publishing or printing,

without the approval first of the chairman of the committee in charge thereof.

16. Bills for current expenses shall be first approved by the Secretary, then sent to the President, and on his approval they shall be paid by check of the Treasurer directly to the parties interested.

17. The actual and necessary travelling expenses of the Secretary and Treasurer to the annual meeting of the Association, and to one meeting of the Executive Committee, shall be classed as current expenses.

RESOLUTIONS.

18. All resolutions presented to the Association shall be sent to the Chair in writing, and referred to a committee without discussion.

ARREARAGES.

19. The arrearages of all members remitting their dues for two years shall be cancelled up to the date of the last payment, but they shall be entitled to the Transactions of the Association only for the years for which they have actually paid.

AUDITING COMMITTEE.

20. An Auditing Committee shall be appointed by the Chair, to audit the accounts of the Treasurer, and report upon the same.

OFFICERS AND COMMITTEES

OF THE

AMERICAN PUBLIC HEALTH ASSOCIATION.

Officers, 1892–1893.

President, ... Dr. Samuel H. Durgin, *Boston, Mass.*
First Vice-President, . Dr. Eduardo Licéaga, *Mexico, Mex.*
Second Vice-President, Dr. Emmanuel P. Lachapelle, *Montreal, P. Q.*
Secretary, ... Dr. Irving A. Watson, *Concord, N. H.*
Treasurer, ... Dr. Henry D. Holton, *Brattleboro', Vermont.*

(*Ex-officio* members Executive Committee.)

STANDING COMMITTEES.

EXECUTIVE COMMITTEE.

(Elective.)

Dr. Francisco Marin . . . . . *Puebla, Mexico.*
Dr. James D. Plunket . . . . . *Nashville, Tenn.*
Dr. J. N. McCormack . . . . . *Bowling Green, Ky.*
Dr. William Bailey . . . . . *Louisville, Ky.*
Dr. Henry F. Hoyt . . . . . *St. Paul, Minn.*
Roberto Gayol, C. E. . . . . *Mexico, Mex.*

(The ex-Presidents, *ex-officio* members Executive Committee.)

Prof. Stephen Smith . . . . . *New York City.*
Dr. Joseph M. Toner . . . . . *Washington, D. C.*
Dr. John H. Rauch . . . . . *Chicago, Ill.*
Major John S. Billings . . . . . *U. S. Army.*
Prof. Robert C. Kedzie . . . . . *Lansing, Mich.*
Dr. Ezra M. Hunt . . . . . *Trenton, N. J.*
Medical Director Albert L. Gihon . . . . . *U. S. Navy.*
Dr. James E. Reeves . . . . . *Chattanooga, Tenn.*
Dr. Henry P. Walcott . . . . . *Cambridge, Mass.*
Surgeon General George M. Sternberg . . . . . *U. S. Army.*
Dr. Charles N. Hewitt . . . . . *Red Wing, Minn.*
Dr. Henry B. Baker, ... *Lansing, Mich.*
Dr. Frederick Montizambert . . . . . *Quebec, Canada.*
Dr. Felix Formento, ... *New Orleans, La.*

ADVISORY COUNCIL.

UNITED STATES:

Alabama,	Dr. JEROME COCHRAN, *Mobile.*
Arkansas,	Dr. H. C. DUNNAVANT, *Osceola.*
California,	Dr. CHARLES A. RUGGLES, *Stockton.*
Colorado,	Dr. HENRY K. STEELE, *Denver.*
Connecticut,	Dr. NATHANIEL E. WORDIN, *Bridgeport.*
Delaware,	Dr. LEWIS P. BUSH, *Wilmington.*
Florida,	Dr. JOSEPH Y. PORTER, *Key West.*
Georgia,	Dr. WILLIAM F. BRUNNER, *Savannah.*
Illinois,	Dr. JOHN H. RAUCH, *Chicago.*
Indiana,	Dr. C. I. FLETCHER, *Indianapolis.*
Iowa,	Dr. FREDERICK BECKER, *Clermont.*
Kansas,	Dr. DANIEL C. JONES, *Topeka.*
Kentucky,	Dr. J. N. MCCORMACK, *Louisville.*
Louisiana,	Dr. LUCIEN F. SALOMON, *New Orleans.*
Maine,	Dr. A. G. YOUNG, *Augusta.*
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New Mexico,	Dr. FRIEND PALMER, *Cerrillos.*
New York,	Dr. JOHN GRIFFIN, *Brooklyn.*
North Carolina,	Dr. HENRY I. BAHNSON, *Salem.*
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Oklahoma Ter.,	Dr. CHARLES F. WALDRON, *Oklahoma City.*
Pennsylvania,	Mr. CROSBY GRAY, *Pittsburgh.*
Rhode Island,	Dr. CHARLES H. FISHER, *Providence.*
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Texas,	Dr. R. M. SWEARINGEN, *Austin.*
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Colima, ... Dr. EUGENIO Z. GOMEZ.
Coahuila, ... Dr. DIONISIO GARCIA FUENTES.
Chihuahua, ... Dr. MIGUEL MARQUEZ.
Chiapas, ... Dr. ANTONIO SALINAS CARBÓ.
Durango, ... Dr. CARLOS SANTA MARIA.
Guanajuato, ... Dr. JESUS CHICO.
Guerrero, ... Dr. ANTONIO BUTEON.
Hidalgo, ... Dr. HEMORIO ANDRADE.
Jalisco, ... Dr. SALVADOR GARCIDIEGO.
Michoacan, ... Dr. L. LEON.
Morelos, ... Dr. NAZARIO LOMAS.
Mexico, ... Dr. CARLOS CHAIX.
Nuevo Leon, ... Dr. P. NORIEGA.
Oaxaca, ... Dr. FRANCISCO ALVAREZ.
Puebla, ... Dr. ANGEL CONTRERAS.
Querétaro, ... Dr. MANUEL SEPTIEN.
San Luis Potosi, . . . Dr. JESUS E. MONJARÁS.
Sonora, ... Dr. ALBERTO G. NORIEGA.
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Dr. MAURICE PERKINS . . . . . Schenectady, N. Y.
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Dr. JOSÉ RAMIREZ . . . . . Mexico, Mex.

ON THE DISPOSAL OF GARBAGE AND REFUSE.

Prof. DELOS FALL . . . . . Albion, Mich.
CROSBY GRAY, Esq. . . . . Pittsburgh, Pa.
RUDOLPH HERING, C. E. . . . . New York City.
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ON ANIMAL DISEASES AND ANIMAL FOOD.

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Prof. JAMES LAW . . . . . Ithaca, N. Y.

Prof. José L. Gómez . . . . . Mexico, Mex.
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ON FORMS OF STATISTICS.

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Dr. Eduardo Licéaga . . . . . Mexico, Mex.

ON PROTECTIVE INOCULATIONS IN INFECTIOUS DISEASES.

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Dr. Ismael Prieto . . . . . Mexico, Mex.
Dr. Nicolas Ramirez de Arellano . . . . . Mexico, Mex.
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Dr. Irving A. Watson, ... Concord, N. H.
Dr. James D. Plunket . . . . . Nashville, Tenn.
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Dr. Charles N. Hewitt . . . . . Red Wing, Minn.
Dr. Joseph Holt . . . . . New Orleans, La.
Dr. J. W. Prendergast . . . . . Cincinnati, Ohio.

ON SANITARY AND MEDICAL SERVICE ON EMIGRANT SHIPS.

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Dr. Frederick Montizambert . . . . . Quebec, P. Q.
Dr. Walter Wyman, Superv'g Surgeon Gen'l, U. S. M. H. S., Washington, D. C.
Dr. Samuel R. Olliphant . . . . . New Orleans, La.
Dr. William T. Jenkins . . . . . Staten Island, N. Y.

ON THE CAUSE AND PREVENTION OF DIPHTHERIA.

Dr. George C. Ashmun . . . . . Cleveland, O.
Dr. Peter H. Bryce . . . . . Toronto, Ont.
Dr. Juan Ramirez de Arellano . . . . . Mexico, Mex.
Dr. Jesus Chico . . . . . Guanajuato, Mex.
Dr. Mendoza Lopez . . . . . Guadalajara, Mex.

ON CAUSES AND PREVENTION OF INFANT MORTALITY.

Dr. Charles N. Hewitt . . . . . Red Wing, Minn.

(With authority to select associates.)

ON RESTRICTION AND PREVENTION OF TUBERCULOSIS.

Dr. J. N. McCormack . . . . . Bowling Green, Ky.
Dr. Lawrence F. Flick . . . . . Philadelphia, Pa.
Dr. Henry B. Baker . . . . . Lansing, Mich.
Dr. Eduardo Licéaga . . . . . Mexico, Mex.
Dr. Juan Breña . . . . . Zacatecas, Mex.

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Dr. Henry B. Horlbeck . . . . . Charleston, S. C.
Dr. Emmanuel P. Lachapelle, ... Montreal, P. Q.
Dr. Samuel R. Olliphant . . . . . New Orleans, La.

ON THE TEACHING OF MILITARY HYGIENE AT WEST POINT.

Dr. James D. Plunket . . . . . Nashville, Tenn.
Dr. Henry P. Walcott . . . . . Cambridge, Mass.
Dr. Henry B. Baker . . . . . Lansing, Mich.

TO SECURE INTERNATIONAL REPRESENTATION AT THE MEETING OF 1893.

Dr. John H. Rauch . . . . . Chicago, Ill.
Dr. A. Nelson Bell . . . . . Brooklyn, N. Y.
Dr. Samuel W. Abbott . . . . . Wakefield, Mass.
Dr. Peter H. Bryce . . . . . Toronto, Ont.
Dr. Charles N. Hewitt . . . . . Red Wing, Minn.
Dr. Frederic J. Mayor . . . . . Lafayette, La.
Dr. Garciadiego Salvador . . . . . Guadalajara, Jalisco, Mex.
Dr. A. A. Woodhull, U. S. A. . . . . Hot Springs, Ark.

ON THE CENTENNIAL OF VACCINATION.

Dr. Joseph M. Toner . . . . . Washington, D. C.
Dr. T. Grange Simons . . . . . Charleston, S. C.
Prof. Charles A. Lindsley . . . . . New Haven, Conn.
Dr. Angel Contreras . . . . . Puebla, Puebla, Mex.
Dr. R. Harvey Reed . . . . . Mansfield, O.

ON INCORPORATION.

Dr. SAMUEL H. DURGIN, *President* . . . . . Boston, Mass.
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Medical Director JOHN MILLS BROWNE, U. S. N. . . . . Washington, D. C.
Dr. SMITH TOWNSHEND . . . . . Washington, D. C.
Dr. HOWARD E. AMES, U. S. N. . . . . Washington, D. C.

At the annual meeting of the Association, held at Kansas City, Mo., Oct. 20–23, 1891, the following resolution was adopted: *Resolved*, That this Association will hold its meeting in 1893 in the city of Chicago, and that, so far as possible, the occasion be made an International Congress of Hygiene and Public Health.

REVISED LIST OF MEMBERS

AMERICAN PUBLIC HEALTH ASSOCIATION,

1893.

This list includes all those who have maintained their membership to the present time, excepting those elected at Mexico, which list will be found in another place. The Secretary should be notified of any errors or omissions.

PRESIDENTS OF THE ASSOCIATION.

Stephen Smith, M. D.	1872, '73, '74
Joseph M. Toner, M. D.	1875
*Edwin M. Snow, M. D.	1876
John H. Rauch, M. D.	1877
*Elisha Harris, M. D.	1878
*James L. Cabell, M. D.	1879
John S. Billings, M. D.	1880
*Charles B. White, M. D.	1881
Robert C. Kedzie, M. D.	1882
Ezra M. Hunt, M. D.	1883
Albert L. Gihon, M. D.	1884
James E. Reeves, M. D.	1885
Henry P. Walcott, M. D.	1886
George M. Sternberg, M. D.	1887
Charles N. Hewitt, M. D.	1888
*Hosmer A. Johnson, M. D.	1889
Henry B. Baker, M. D.	1890
Frederick Montizambert, M. D.	1891
Felix Formento, M. D.	1892
Samuel H. Durgin, M. D.	1893

ACTIVE MEMBERS.

Dr. Alex. C. Abbott	Baltimore, Md.	1889
Dr. Samuel W. Abbott	Wakefield, Mass.	1882
Dr. C. A. Abernathy	Pulaski, Tenn.	1891
Dr. Edward Thomas Abrams	Dollar Bay, Mich.	1891
Dr. Charles W. Adams	Kansas City, Mo.	1891
Julius W. Adams, C. E., Congress St.	Brooklyn, N. Y.	1889
Dr. J. F. A. Adams	Pittsfield, Mass.	1881

* Deceased.

C. H. Alden, U. S. A. . . . . St. Paul, Minn. 1887
Edwin R. Allen, V. S. . . . . Kansas City, Mo. 1891
Dr. John M. Allen . . . . . Liberty, Mo. 1891
Dr. Norman Allen . . . . . Toronto, Ont. 1891
Dr. Willis G. Alling . . . . . New Haven, Conn. 1885
Dr. Charles D. Alton, 86 Farmington Ave. . . . Hartford, Conn. 1890
Dr. Austin White Alvord . . . . . Battle Creek, Mich. 1887
Dr. Charles Ambrook . . . . . Boulder, Col. 1878
Dr. Azel Ames, Jr. . . . . Chicago, Ill. 1875
Dr. A. A. Ames . . . . . Minneapolis, Minn. 1887
Dr. Howard E. Ames, P. A. Surgeon U. S. Navy,
Museum of Hygiene . . . . . Washington, D. C. 1890
John A. Anderson . . . . . Lambertville, N. J. 1887
Prof. Edmund R. Angell, ... Derry, N. H. 1889
George T. Angell, Esq. . . . . Boston, Mass. 1878
Dr. O. W. Archibald . . . . . Jamestown, N. D. 1888
Dr. J. S. Arwine . . . . . Columbus, Ind. 1882
Dr. G. C. Ashmun . . . . . Cleveland, Ohio. 1881
Hon. Edward Atkinson . . . . . Boston, Mass. 1889
Prof. W. O. Atwater . . . . . Washington, D. C. 1889
Dr. H. W. Austin, U. S. M. H. S. . . . . Washington, D. C. 1880
Dr. James F. Aydelotte . . . . . Decaturville, Tenn. 1891
Dr. James Woods Babcock . . . . . Columbia, S. C. 1891
Dr. William Bailey . . . . . Louisville, Ky. 1879
Dr. P. H. Bailhache, U. S. M. H. S. . . . . San Francisco, Cal. 1874
Dr. Henry B. Baker . . . . . Lansing, Mich. 1873
Dr. Henry I. Bahnson . . . . . Salem, N. C. 1888
Dr. Lewis Balch . . . . . Albany, N. Y. 1888
Dr. F. Bancroft . . . . . Denver, Col. 1887
Louis J. Barbot, C. E. . . . . Charleston, S. C. 1890
Dr. T. G. Barnhill . . . . . Findlay, Ohio. 1882
James W. Bartlett . . . . . Dover, N. H. 1888
Dr. Samuel W. Battle, U. S. A. . . . . Asheville, N. C. 1887
Dr. Elias Hudson Bartley, 21 Lafayette Ave. . . . Brooklyn, N. Y. 1890
Edward Bausch . . . . . Rochester, N. Y. 1884
Dr. R. O. Beard . . . . . Minneapolis, Minn. 1888
Dr. Benjamin Franklin Beardsley . . . . . Hartford, Conn. 1889
Dr. J. A. Beaudrey, 65 St. Denis St. . . . . Montreal, P. Q. 1889
Dr. C. W. Beaumont . . . . . Clarksville, Tenn. 1891
Dr. Frederick Becker . . . . . Clermont, Iowa. 1889
Dr. W. F. Becker . . . . . Milwaukee, Wis. 1888
Dr. D. H. Beckwith . . . . . Cleveland, Ohio. 1884
Dr. Henry E. Beebe . . . . . Sidney, Ohio. 1882
Dr. A. N. Bell, 291 Union St. . . . . Brooklyn, N. Y. 1872
Dr. Harry Kent Bell . . . . . Brooklyn, N. Y. 1888
George N. Bell, C. E. . . . . Philadelphia, Pa. 1889
Dr. John J. Berry . . . . . Portsmouth, N. H. 1886
Dr. John S. Billings, U. S. A. . . . . Washington, D. C. 1872

Dr. William T. Bishop . . . . . Harrisburg, Pa. 1889
Dr. Mary Taylor Bissell, 19 E. 46th St. . . . . New York City. 1889
Dr. John E. Black . . . . . Memphis, Tenn. 1887
C. H. Blackburn, Esq., 512 Colerain Ave. . . . . Cincinnati, Ohio. 1889
Dr. Emily Blackwell, 53 E. 20th St. . . . . New York City. 1873
Dr. John P. Blankenship . . . . . Maryville, Tenn. 1891
E. W. Blatchford, 375 No. La Salle St. . . . . Chicago, Ill. 1876
Dr. Delavan Bloodgood, U. S. N. . . . . Brooklyn, N. Y. 1890
Dr. Thomas Blauch Bloomfield . . . . . Westbrook, Conn. 1889
Dr. Frans H. Bodenius . . . . . Madison, Wis. 1888
Benjamin Meade Bolton, Hoagland Lab'y, Montague St., Brooklyn, N. Y. 1889
Dr. Moses H. Bonner . . . . . Nashville, Tenn. 1891
Dr. C. E. Booth . . . . . Winnebago, Wis. 1888
Frederick N. Boxer, C. E. . . . . Montreal, P. Q. 1885
Dr. S. B. Boyd . . . . . Knoxville, Tenn. 1891
Joseph H. Brady, 1331 Walnut St. . . . . Kansas City, Mo. 1891
Dr. Julius Braunnagel, 250 South Laredo St. . . San Antonio, Tex. 1890
Prof. William H. Brewer . . . . . New Haven, Conn. 1874
Dr. M. D. Brochu, 130 St. Francis St. . . . . Quebec, P. Q. 1889
Dr. Benjamin T. Brodie . . . . . Detroit, Mich. 1888
Joseph O. Brown . . . . . Pittsburgh, Pa. 1888
Dr. John M. Browne, Surgeon-General U. S. N. . Washington, D. C. 1883
Dr. William Francis Brunner, 50 Harris St. . . Savannah, Ga. 1890
Dr. Peter H. Bryce . . . . . Toronto, Ont. 1883
Dr. Erastus J. Buck . . . . . Platteville, Wis. 1888
Dr. J. Somers Buist . . . . . Charleston, S. C. 1890
Hon. T. B. Bullene . . . . . Kansas City, Mo. 1891
Dr. J. Grattan Cabell . . . . . Richmond, Va. 1873
Dr. John H. Callender . . . . . Nashville, Tenn. 1891
Dr. Allan Cameron . . . . . Owen Sound, Ont. 1886
Dr. James Campbell . . . . . Hartford, Conn. 1888
Dr. Michael Campbell . . . . . Knoxville, Tenn. 1891
Dr. William Canniff . . . . . Toronto, Ont. 1883
Dr. G. M. D. Cantrell . . . . . Little Rock, Ark. 1881
Dr. A. W. Cantwell . . . . . Davenport, Iowa. 1880
Dr. H. R. Carter, U. S. M. H. S. . . . . Washington, D. C. 1890
Prof. Stanford E. Chaillé . . . . . New Orleans, La. 1874
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Dr. Charles V. Chapin . . . . . Providence, R. I. 1886
Dr. Walter H. Chapin . . . . . Springfield, Mass. 1889
John C. Chase, C. E. . . . . Wilmington, N. C. 1890
Dr. Jesus Chico, 2 Estrella St. . . Guanajuato City, Guanajuato, Mex. 1891
Dr. Thomas Teasdale Church, 70 E. Main St. . . . Salem, Ohio. 1890
Hon. J. W. Clapp . . . . . Memphis, Tenn. 1879
Dr. Edwin Clark . . . . . Buffalo, N. Y. 1888
Dr. A. P. Clarke . . . . . Cambridge, Mass. 1887
Dr. E. F. X. Cleveland . . . . . Dundee, Ill. 1887

Dr. A. A. Clough . . . . . Denver, Col. 1889
Dr. Jerome Cochran . . . . . Mobile, Ala. 1878
Dr. Charles E. Cole . . . . . Wauzeka, Wis. 1888
Dr. Edward W. Cole . . . . . Nashville, Tenn. 1887
Dr. N. B. Cole . . . . . Bloomington, Ill. 1888
Dr. F. H. Colton . . . . . Brooklyn, N. Y. 1889
Dr. G. P. Conn . . . . . Concord, N. H. 1875
Dr. P. S. Conner . . . . . Cincinnati, Ohio. 1884
Dr. Henry J. Connor . . . . . West Superior, Wis. 1888
Dr. Isaac Cooper, 194 Broad St. . . . . Trenton, N. J. 1889
Hon. W. F. Cooper . . . . . New York City. 1879
Dr. John C. Corbus . . . . . Mendota, Ill. 1889
Julius Cotz, S. E. . . . . Atlantic City, N. J. 1889
Dr. W. T. Councilman . . . . . Baltimore, Md. 1887
Dr. John Coventry . . . . . Windsor, Ont. 1886
Dr. C. W. Covernton . . . . . Toronto, Ont. 1884
Dr. J. B. Cowan . . . . . Tullahoma, Tenn. 1891
Dr. G. G. Craig . . . . . Rock Island, Ill. 1880
J. James R. Croes, C. E., 13 William St. . . . . New York City. 1877
Algernon S. Currey, Esq. . . . . Trenton, Tenn. 1891
Dr. David M. Currier . . . . . Newport, N. H. 1883
Dr. F. C. Curtis . . . . . Albany, N. Y. 1883
Dr. Charles O. Curtman . . . . . St. Louis, Mo. 1884
Dr. William P. Cutler, 1227 Michigan St. . . . Kansas City, Mo. 1891
Dr. Jacob M. DaCosta . . . . . Philadelphia, Pa. 1874
Dr. J. P. Dake . . . . . Nashville, Tenn. 1879
Dr. R. P. Daniell . . . . . Jacksonville, Fla. 1890
Prof. W. W. Daniells . . . . . Madison, Wis. 1886
Dr. H. C. Darby . . . . . Wilmot, Wis. 1888
Dr. Hiram H. Darr . . . . . Caldwell, Tex. 1883
Dr. James Darrach . . . . . Germantown, Pa. 1874
Dr. B. F. Davenport, 116 Tremont St. . . . . Boston, Mass. 1884
J. J. Davenport, Esq., 309 Massachusetts Building Kansas City, Mo. 1891
Dr. Frederick Francis D'Avignon . . . . . Leadville, Col. 1891
Prof. Floyd Davis, Ph. D. . . . . Socorro, N. M. 1890
Dr. Frank E. Davis, 499 Hancock St. . . . . Brooklyn, N. Y. 1889
Chester B. Davis, C. E., The Rookery . . . . . Chicago, Ill. 1886
Dr. N. S. Davis, 291 Huron St. . . . . Chicago, Ill. 1887
Dr. Thomas Spencer Dawes, 245 Main St. . . . Saugerties, N. Y. 1891
Dr. Dwight W. Day . . . . . Eau Claire, Wis. 1888
Dr. John H. Dearborn, 265 Cabot St. . . . . Beverly, Mass. 1891
Dr. Louis S. DeForest . . . . . New Haven, Conn. 1889
Dr. William Deming . . . . . Litchfield, Conn. 1888
Dr. Laban Dennis . . . . . Newark, N. J. 1877
Prof. J. E. Denton, Stevens Institute of Technology . Hoboken, N. J. 1891
Dr. Gustavus Devron . . . . . New Orleans, La. 1878
Dr. William B. Dewees, 542 South Santa Fé Ave. . . . Salina, Kan. 1891
Dr. Oscar C. DeWolf . . . . . Chicago, Ill. 1880

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Dr. John C. Dozier	Birmingham, Ala.	1887
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George A. Drake	Rozellville, Wis.	1889
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Andrew Engle	Des Moines, Iowa.	1888
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A. B. Farquhar, Esq.	York, Pa.	1880
Dr. J. D. Fernandez	Jacksonville, Fla.	1890
Dr. James B. Field	Lowell, Mass.	1889
Dr. J. D. Fields	Manor, Tex.	1880
Gustave Fleischmann	Buffalo, N. Y.	1888
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Dr. Louis Fleischmann	New York City.	1890
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Dr. Corydon L. Ford	Ann Arbor, Mich.	1872
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Dr. Felix Formento	New Orleans, La.	1880
Dr. Eugene Foster	Augusta, Ga.	1881
Dr. S. B. Fowler	Gainesboro, Tenn.	1891
Dr. Charles J. Fox	Willimantic, Conn.	1887

Hon. DAVID R. FRANCIS . . . . . Jefferson City, Mo. 1891
Dr. H. T. FRASER . . . . . Charleston, S. C. 1880
Dr. SPENCER M. FREE . . . . . Du Bois, Pa. 1885
WILLIAM S. FRENCH, C. E. . . . . West Newton, Mass. 1889
Dr. ANDREW L. FULTON . . . . . Kansas City, Mo. 1887
Dr. JOHN F. FULTON . . . . . St. Paul, Minn. 1888
Dr. CLARKE GAPEN, 131 S. 25th St. . . . . Omaha, Neb. 1891
Prof. JAMES T. GARDNER . . . . . Albany, N. Y. 1875
Dr. JOSEPH L. GASTON . . . . . Chattanooga, Tenn. 1891
Dr. J. D. GATCH . . . . . Lawrenceburg, Ind. 1879
Dr. SAMUEL H. GAULT . . . . . Rogersville, Tenn. 1891
Dr. FRANKLIN GAUNTT . . . . . Burlington, N. J. 1885
Dr. A. GAVIÑO, Ratas No. 4 . . . . . Mexico, Mex. 1891
ROBERTO GAYOL, C. E. . . . . Mexico, Mex. 1891
Dr. JOHN B. C. GAZZO . . . . . Thibodeaux, La. 1887
Dr. H. D. GEDDINGS, U. S. M. H. S. 1889
WILLIAM PAUL GERHARD, C. E., 39 Union Sq. W. . New York City. 1880
Dr. FREDERICK H. GERRISH . . . . . Portland, Me. 1885
RICHARD FITZ GIBBON . . . . . Bridgeport, Conn. 1889
Prof. WOLCOTT GIBBS . . . . . Newport, R. I. 1876
Dr. ALBERT L. GIHON, U. S. N. . . . . Washington, D. C. 1876
Dr. GRANDISON A. GOBEN . . . . . Kirkesville, Mo. 1891
Dr. JOHN GODFREY, U. S. M. H. S. . . . . New York City. 1888
Prof. JOSÉ L. GÒMEZ, 3 San Lorenzo St. . . . . Mexico, Mex. 1890
Dr. R. S. GOODWIN . . . . . Thomaston, Conn. 1886
Mr. GRAHAM . . . . . Toronto, Ont. 1891
Dr. JOHN H. GRANNISS . . . . . Old Saybrook, Conn. 1889
Dr. E. E. GRAVES . . . . . Boscawen, N. H. 1886
CROSBY GRAY . . . . . Pittsburgh, Pa. 1874
HENRY R. GRAY, 144 St. Lawrence Main . . . . . Montreal, P. Q. 1886
Dr. MASON W. GRAY, 9 Saginaw St., N. . . . . Pontiac, Mich. 1891
SAMUEL M. GRAY, C. E., 16 Larch St. . . . . Providence, R. I. 1891
Dr. JOHN J. GREEN . . . . . Pittsburgh, Pa. 1884
Gen. COLTON GREENE . . . . . Memphis, Tenn. 1880
Dr. WALTER D. GREENE, ... Buffalo, N. Y. 1890
Dr. JAMES G. GREGORY . . . . . Norwalk, Conn. 1889
Dr. EDGERTON GRIFFIN . . . . . Brantford, Ont. 1886
Dr. JOHN GRIFFIN, 90 Sands St. . . . . Brooklyn, N. Y. 1888
Dr. BENJAMIN M. GRIFFITH . . . . . Springfield, Ill. 1891
Dr. JEFFERSON D. GRIFFITH . . . . . Kansas City, Mo. 1891
ROBERT GRIFFITH, 427 Clark St. . . . . Chicago, Ill. 1890
Dr. WILLIAM EDWARD GRIFFITHS, 320 Schermerhorn St. Brooklyn, N. Y. 1889
Dr. J. C. GRONVOLD . . . . . Norway, Minn. 1886
Dr. EDWARD A. GUILBERT . . . . . Dubuque, Iowa. 1890
Dr. P. J. GUILLOT. . . . . Bushkill, Pa. 1887
HENRY A. GUINZBURG . . . . . St. Louis, Mo. 1891
Dr. MANUEL GUTIERREZ, 13 Aduana Vieja . . . . . Mexico, Mex. 1891
Dr. ALEXANDER HADDEN, 155 E. 51st St. . . . . New York City. 1889

Hon. D. P. Hadden . . . . . Memphis, Tenn. 1880
Dr. Frederick D. Haldeman . . . . . Ord, Neb. 1891
Dr. Junius M. Hall . . . . . Chicago, Ill. 1880
Dr. Lucy M. Hall, 181 Joralemon St. . . . . Brooklyn, N. Y. 1889
W. E. Hall . . . . . Kansas City, Mo. 1891
Dr. William G. Hall . . . . . St. Joseph, Mo. 1891
Dr. John B. Hamilton, Sherman House . . . . . Chicago, Ill. 1886
Dr. J. H. Hamilton . . . . . Richford, Vt. 1891
Hon. T. F. Hannon . . . . . Kansas City, Mo. 1891
Dr. Thomas J. Happel . . . . . Trenton, Tenn. 1891
Dr. R. A. Hardin . . . . . Savannah, Ga. 1879
Dr. W. S. Harding . . . . . St. John, N. B. 1886
Dr. Robert B. S. Hargis . . . . . Pensacola, Fla. 1878
Dr. Henry Hartshorne . . . . . Germantown, Pa. 1872
Dr. W. A. Haskell . . . . . Alton, Ill. 1883
Dr. Thomas Hay, 1127 Arch St. . . . . Philadelphia, Pa. 1874
Dr. Arthur Hazlewood . . . . . Grand Rapids, Mich. 1889
J. M. Hazen, 1512 Park Ave. . . . . Minneapolis, Minn. 1889
Rudolph Hering, C. E., 277 Pearl St. . . . . New York City. 1878
Dr. Charles N. Hewitt . . . . . Red Wing, Minn. 1872
Dr. John B. Hibben . . . . . Topeka, Kan. 1891
Dr. J. F. Hibberd . . . . . Richmond, Ind. 1881
Dr. John F. Hicks . . . . . Menominee, Mich. 1888
Prof. Edward Hitchcock . . . . . Amherst, Mass. 1877
Dr. Cornelius N. Hoagland, 710 Clinton Ave. . . . Brooklyn, N. Y. 1887
Dr. John U. Hobach, Union Station . . . . . Baltimore, Md. 1888
Herman Hollerith, 501 F St. . . . . Washington, D. C. 1887
Hon. Benjamin Holmes . . . . . Kansas City, Mo. 1891
Dr. Joseph Holt . . . . . New Orleans, La. 1880
Dr. Henry D. Holton . . . . . Brattleboro, Vt. 1875
Dr. George Homan, 919 Olive St. . . . . St. Louis, Mo. 1879
Dr. H. B. Horlbeck . . . . . Charleston, S. C. 1880
Dr. Asa Horr . . . . . Dubuque, Iowa. 1872
Hon. Albert H. Horton . . . . . Topeka, Kan. 1891
Dr. Henry F. Hoyt . . . . . St. Paul, Minn. 1884
Dr. William H. Huger . . . . . Charleston, S. C. 1890
Hon. Lyman U. Humphrey . . . . . Topeka, Kan. 1891
Dr. A. Clark Hunt . . . . . Metuchen, N. J. 1888
Dr. C. C. Hunt . . . . . Dixon, Ill. 1889
Dr. Ezra M. Hunt . . . . . Trenton, N. J. 1872
Dr. Fred N. Hunt . . . . . Fairmont, Minn. 1889
Dr. Joseph H. Hunt, cor. Quincy St. and Bedford Ave. Brooklyn, N. Y. 1889
Dr. C. H. Hunter . . . . . Minneapolis, Minn. 1888
Dr. Randall R. Hunter . . . . . Kansas City, Mo. 1890
Dr. H. M. Hurd . . . . . Baltimore, Md. 1883
Dr. Alexander Hutchins, 796 DeKalb Ave. . . . . Brooklyn, N. Y. 1889
Dr. Ramon Icaza, 9 Ratas St. . . . . Mexico, Mex. 1891
L. E. Irwin . . . . . Kansas City, Mo. 1891

Dr. JOHN W. JACKSON . . . . . Kansas City, Mo. 1884
Dr. R. N. JACKSON . . . . . Faribault, Minn. 1889
Rev. D. C. JACOKES, S. T. D. . . . . Pontiac, Mich. 1882
Dr. BUSHROD W. JAMES, cor. 18th and Green Sts. . . Philadelphia, Pa. 1878
Dr. GEORGE W. JENKINS . . . . . Kilbourn City, Wis. 1888
Dr. ANDREW J. B. JENNER . . . . . Detroit, Mich. 1883
Dr. JAMES W. JENNEY . . . . . Salina, Kan. 1891
Dr. L. M. DE JESI, 21 Plaza de Armas . . . . . Zacatecas, Mex. 1891
C. F. JOHNSON, 3 to 9 Beekman St. . . . . New York City. 1889
Dr. GEORGE H. T. JOHNSON . . . . . Atchison, Kan. 1891
Dr. SAM C. JOHNSON . . . . . Hudson, Wis. 1884
Dr. WIRT JOHNSTON . . . . . Jackson, Miss. 1878
Dr. D. C. JONES . . . . . Topeka, Kan. 1887
Dr. H. ISAAC JONES, 118 Grant Ave. . . . . San Francisco, Cal. 1880
Dr. J. W. JONES . . . . . Tarborough, N.C. 1885
Dr. LEANDER P. JONES . . . . . Greenwich, Conn. 1889
EDWARD C. JORDAN, C. E. . . . . Portland, Me. 1886
Hon. J. M. KEATING . . . . . Memphis, Tenn. 1880
Dr. ROBERT C. KEDZIE . . . . . Lansing, Mich. 1873
Dr. J. H. KELLOGG . . . . . Battle Creek, Mich. 1878
GEORGE T. KEMP, Ph. D., 173 Joralemon St. . . . Brooklyn, N. Y. 1889
Dr. J. F. KENNEDY . . . . . Des Moines, Iowa. 1885
Dr. ISAAC N. KERLIN . . . . . Elwyn, Pa. 1874
Dr. JOHN H. KINYOUN . . . . . Centre View, Mo. 1891
Dr. JOS. J. KINYOUN, U. S. M. H. S. . . . . Washington, D. C. 1891
Dr. SAMUEL S. KILVINGTON . . . . . Minneapolis, Minn. 1887
Dr. G. M. KIMBALL . . . . . Concord, N. H. 1886
Dr. CHARLES F. KING . . . . . Hudson, Wis. 1888
Dr. WILLIAM F. KNOX . . . . . McKeesport, Pa. 1887
Dr. CORNELIUS KOLLOCK . . . . . Cheraw, S. C. 1884
Dr. WILLIAM KRAUSS . . . . . Memphis, Tenn. 1891
EMIL KUICHLING, C. E. . . . . Rochester, N. Y. 1882
Dr. LOUIS LABERGE . . . . . Montreal, P. Q. 1886
Dr. EMMANUEL P. LACHAPELLE . . . . . Montreal, P. Q. 1887
Dr. S. W. LATTA . . . . . Trenton, N. J. 1885
Prof. JAMES LAW . . . . . Ithaca, N. Y. 1872
Dr. JOHN LAINY LEAL, 149 Ellison St. . . . . Paterson, N. J. 1891
Dr. BENJAMIN LEE, 1522 Pine St. . . . . Philadelphia, Pa. 1874
Dr. WILLIAM LEE, 2111 Penn. Ave. . . . . Washington, D. C. 1874
L. Z. LEITER, Esq., P. O. Drawer L . . . . . Chicago, Ill. 1876
WILLIAM T. LEMP . . . . . St. Louis, Mo. 1884
Dr. B. B. LENOIR . . . . . Lenoir's, Tenn. 1879
Hon. WILLIAM P. LETHWORTH . . . . Glen Iris, Portageville, N. Y. 1874
Dr. JOHN B. LEARNED . . . . . Florence, Mass. 1889
WALLACE G. LEVISON, 317 Livingston St. . . . . Brooklyn, N. Y. 1889
Dr. PHILIP W. LEWELLYN . . . . . Clarinda, Iowa. 1890
Dr. HENRY M. LEWIS, 171 Remsen St. . . . . Brooklyn, N. Y. 1889
Dr. H. H. LEVY . . . . . Richmond, Va. 1878

Dr. Eugene R. Lewis . . . . . Kansas City, Mo. 1884
Dr. Francis W. Lewis, 2016 Spruce St. . . . . Philadelphia, Pa. 1874
Dr. Eduardo Licéaga, 4 San Andres St. . . . . Mexico, Mex. 1891
Dr. Charles A. Lindsley . . . . . New Haven, Conn. 1875
Dr. J. Berrien Lindsley . . . . . Nashville, Tenn. 1877
Dr. J. M. Lindsley . . . . . Nashville, Tenn. 1879
Dr. John B. Lineham, 301 Mott St. . . . . New York City. 1889
Dr. Nazario Lomas, 3 Hidalgo St. . . Cuernavaca, Morelos, Mex. 1891
James L. Loring, C. E. . . . . Dallas Centre, Iowa. 1890
Hon. Seth Low, 201 Columbia Heights . . . . . Brooklyn, N. Y. 1889
Harvey C. Lowrie, C. E. . . . . Denver, Col. 1886
Jacob Lott Ludlow, C. E. . . . . Winston, N. C. 1891
Alan Macdougall, C. E. . . . . Toronto, Ont. 1886
Dr. Hugh W. Mackay . . . . . Woodstock, Ont. 1889
William S. MacHarg, C. E., 14 Pacific Ave. . . . . Chicago, Ill. 1889
Dr. James H. Maddox . . . . . Stafford, Miss. 1887
Dr. G. E. Manigault . . . . . Charleston, S. C. 1890
Dr. Francisco Marin . . . . . Puebla, Puebla, Mex. 1891
Dr. Solon Marks . . . . . Milwaukee, Wis. 1876
Dr. Albert Marois, 51 St. Louis St. . . . . Quebec, P. Q. 1889
Dr. E. J. Marsh . . . . . Paterson, N. J. 1872
Edward F. Martin, 301 Mott St. . . . . New York City. 1889
Dr. Robert Martin . . . . . Milwaukee, Wis. 1885
Charles D. Marx, C. E., Leland Stanford, Jr., University, Palo Alto, Cal. 1886
Dr. George T. Maxwell . . . . . Jacksonville, Fla. 1889
Dr. Ezra S. McClellan . . . . . Paterson, N. J. 1889
Dr. J. H. McClelland . . . . . Pittsburg, Pa. 1885
Dr. J. H. McCollom, 57 Dwight St. . . . . Boston, Mass. 1884
Dr. J. N. McCormack . . . . . Bowling Green, Ky. 1880
Dr. John R. McDill . . . . . Milwaukee, Wis. 1888
Dr. Calvin D. McDonald . . . . . Kansas City, Mo. 1889
Dr. L. D. McIntosh, 141 Wabash Ave. . . . . Chicago, Ill. 1888
Dr. W. Page McIntosh, U. S. M. H. S., U. S. Quarantine Station . . . . . San Francisco, Cal. 1885
Dr. McKeoun . . . . . Toronto, Ont. 1891
W. P. McLaren, Esq. . . . . Milwaukee, Wis. 1888
Dr. John T. McLean . . . . . Alameda, Cal. 1889
Hon. Albert L. McNeal . . . . . Bolivar, Tenn. 1879
I. C. McNeill, 1315 E 22d St. . . . . Kansas City, Mo. 1891
Dr. John Mears, 28 and 30 Times Building . . Kansas City, Mo. 1891
Dr. Allard Memminger . . . . . Charleston, S. C. 1890
Dr. Gregorio Mendizabal, 2 S. Miguel St. Orizaba, Vera Cruz, Mex. 1891
Dr. G. W. Menees . . . . . Springfield, Tenn. 1891
Dr. Alfred Mercer . . . . . Syracuse, N. Y. 1886
Hon. George A. Mercer . . . . . Savannah, Ga. 1881
Dr. Albert Merrell, 3814 Washington Ave. . . . St. Louis, Mo. 1891
Dr. Charles N. Metcalf . . . . . Indianapolis, Ind. 1885
Henry C. Meyer, C. E. . . . . New York City. 1882

Dr. Middleton Michel . . . . . Charleston, S. C. 1890
Dr. Edwin Middlebrook, 1010 Grand Ave. . . Kansas City, Mo. 1891
Prof. John B. Minor . . . . . University of Virginia, Va. 1878
Andrew S. Mitchell . . . . . Milwaukee, Wis. 1888
Dr. Charles Mitchell . . . . . Nashville, Tenn. 1884
Dr. Henry Mitchell . . . . . Asbury Park, N. J. 1886
Dr. Jesse B. Mitchell . . . . . Datura, Tenn. 1891
Dr. R. W. Mitchell . . . . . Memphis, Tenn. 1878
Dr. John L. Moffat, 17 Schermerhorn St. . . . Brooklyn, N. Y. 1889
Dr. Ruben C. Moffat, 17 Schermerhorn St. . . . Brooklyn, N. Y. 1889
Dr. Jesus E. Monjaras, Cinco de Mayo . . . San Luis Potosi, Mex. 1891
C. Monjeau . . . . . Cincinnati, O. 1887
Dr. L. H. Montgomery . . . . . Chicago, Ill. 1879
Dr. Frederick Montizambert . . . Grosse Isle, Quebec, P. Q. 1885
Dr. J. Fred Moore, 444 Pacific St. . . . . Brooklyn, N. Y. 1886
Robert Moore, C. E. . . . . St. Louis, Mo. 1880
Dr. Emma W. Mooers . . . . . Arlington, Mass. 1888
David Percy Morgan, 106 E. 37th St. . . . . New York City. 1885
Dr. John Morris . . . . . Baltimore, Md. 1874
Dr. J. Cheston Morris, 1514 Spruce St. . . . . Philadelphia, Pa. 1883
Dr. Prince A. Morrow, 66 W. 40th St. . . . . New York City. 1889
William F. Morse, S. E., 30 State St. . . . . New York City. 1889
Dr. Eliza M. Mosher, 181 Joralemon St. . . . . Brooklyn, N. Y. 1889
Dr. Byron Wooster Munson . . . . . Sharon, Conn. 1889
Dr. J. B. Murfree . . . . . Murfreesboro, Tenn. 1891
Alexander W. Murray, 811 W. Madison St. . . . Chicago, Ill. 1884
Dr. Robert D. Murray, U. S. M. H. S. . . . . Key West, Fla. 1872
Dr. R. D. Mussey . . . . . Glendale, Ohio. 1889
Dr. John T. Nagle, 301 Mott St. . . . . New York City. 1874
Dr. A. Nash . . . . . Joliet, Ill. 1887
Dr. Herbert M. Nash . . . . . Norfolk, Va. 1878
Dr. E. A. Neeley, 126 Hernando St. . . . . Memphis, Tenn. 1891
Dr. William K. Newton . . . . . Paterson, N. J. 1883
Dr. Frank P. Norbury . . . . . Jacksonville, Ill. 1889
Dr. Alberto Noriega . . . . . Hermosillo, Sonora, Mex. 1891
Dr. Pedro Noriega, 83 Dr. Mier St. . Monterey, Neuvo Leon, Mex. 1891
Dr. R. J. Nunn . . . . . Savannah, Ga. 1881
Dr. George H. F. Nuttall, Ph. D. . . . . Baltimore, Md. 1891
Dr. M. O'Brien . . . . . Topeka, Kan. 1891
Dr. M. C. O'Connor . . . . . New Haven, Conn. 1888
Dr. William Oldright . . . . . Toronto, Ont. 1883
Frederick Law Olmstead, Esq. . . . . Brookline, Mass. 1872
Dr. H. S. Orme . . . . . Los Angeles, Cal. 1885
Dr. John G. Orton . . . . . Binghamton, N. Y. 1890
Dr. Domingo Orvañanos, 25 Chavarria St. . . . . Mexico, Mex. 1890
Michael J. O'Shaughnessy . . . . . Huntsville, Ala. 1879
Dr. William C. Otterson, 144 Pierrepont St. . . Brooklyn, N. Y. 1887
F. N. Owen, C. E., 13 William St. . . . . New York City. 1883

Dr. William O. Owen . . . . . Lynchburg, Va. 1887
Dr. Frank K. Paddock . . . . . Pittsfield, Mass. 1889
Dr. A. H. Paquet . . . . . St. Cuthbert, P. Q. 1889
Dr. Paul Paquin, D. V. S. . . . . Battle Creek, Mich. 1891
Dr. J. M. Partridge . . . . . South Bend, Ind. 1881
Dr. George Peck, U. S. Navy, 926 N. Broad St. . . Elizabeth, N. J. 1890
Dr. Ozias W. Peck . . . . . Oneonta, N. Y. 1887
Dr. C. T. Peckham, U. S. M. H. S. . . . . St. Louis, Mo. 1887
Henry E. Pellew, Esq. . . . . Katonah, N. Y. 1876
Dr. J. W. Penn . . . . . Humboldt, Tenn. 1891
Dr. Maurice Perkins . . . . . Schenectady, N. Y. 1888
Dr. N. J. Pettijohn . . . . . Kansas City, Mo. 1891
Dr. D. L. Phares . . . . . Agricultural College, Miss. 1880
Dr. Hugo Philler . . . . . Waukesha, Wis. 1888
Dr. J. H. Phillips . . . . . Preston, Minn. 1890
Hon. Edwin L. Pillsbury, 12 Beacon St. . . . . Boston, Mass. 1889
Dr. Edward Playter . . . . . Ottawa, Ont. 1886
Dr. Samuel C. Plummer . . . . . Rock Island, Ill. 1888
Dr. J. D. Plunket . . . . . Nashville, Tenn. 1878
Miss Emma C. G. Polson . . . . . New Haven, Conn. 1888
Dr. Joseph Y. Porter, U. S. A. . . . . Key West, Fla. 1878
Dr. Thomas K. Powell . . . . . Dancyville, Tenn. 1879
Dr. Thomas Powell, 762 Judson St. . . . . Fort Scott, Kan. 1891
Dr. J. W. Prendergast . . . . . Cincinnati, O. 1890
Dr. Charles W. Preston, 570 Leonard St. . . . Brooklyn, N. Y. 1888
Dr. C. O. Probst . . . . . Columbus, Ohio. 1886
George T. Putnam . . . . . Kansas City, Mo. 1891
Dr. Francis Rae . . . . . Oshawa, Ont. 1886
Dr. J. B. Ralph . . . . . Omaha, Neb. 1889
John E. Randall . . . . . Memphis, Tenn. 1887
Dr. John H. Rauch, Grand Pacific Hotel . . . . . Chicago, Ill. 1872
Dr. William C. Ravenel . . . . . Charleston, S. C. 1890
Dr. Joseph H. Raymond, 173 Joralemon St. . . . Brooklyn, N. Y. 1882
Hon. Harrison Reed . . . . . Jacksonville, Fla. 1888
Dr. R. Harvey Reed . . . . . Mansfield, Ohio. 1884
Dr. J. T. Reeve . . . . . Appleton, Wis. 1876
Dr. James E. Reeves . . . . . Chattanooga, Tenn. 1872
Dr. Edward A. Reiley, 312 Baldwin St. . . . . Elmira, N. Y. 1890
Dr. Peter Charles Remondino, corner F and Sixth Sts., San Diego, Cal. 1890
Dr. Ephraim M. Reynolds . . . . . Centreville, Iowa. 1890
Dr. Albert R. Rice . . . . . Springfield, Mass. 1884
Mrs. E. H. Richards, Institute Technology . . . . Boston, Mass. 1888
C. L. Richards . . . . . Davenport, Iowa. 1887
Edgar Richards, 1621 H St. . . . . Washington, D. C. 1889
Dr. C. T. Richardson . . . . . Charleston, W. Va. 1881
Dr. Dwight A. Richardson . . . . . Shelton, Conn. 1885
Maj. Henry B. Richardson, C. E. . . . . New Orleans, La. 1880
Dr. W. L. Richardson, 225 Commonwealth Ave. . . Boston, Mass. 1875

Dr. J. M. Ridge . . . . . Kansas City, Mo. 1891
Dr. William C. Rives, 113 E. 38th St. . . . . New York City. 1885
Dr. John B. Roberts, 1627 Walnut St. . . . . Philadelphia, Pa. 1886
Dr. William Pinckney Roberts, 1 N. Madison St. . Evansville, Wis. 1891
James S. Robinson . . . . . Memphis, Tenn. 1887
Prof. Franklin C. Robinson . . . . . Brunswick, Me. 1889
Dr. John B. Robinson . . . . . Omaha, Neb. 1889
Dr. Francis J. Rogers . . . . . Stamford, Conn. 1889
Dr. S. A. Rogers . . . . . Memphis, Tenn. 1891
Dr. George H. Rohé . . . . . Baltimore, Md. 1880
Dr. Henry W. Rose . . . . . Westerly, R. I. 1886
Dr. Ross B. Rowe . . . . . Reading, Pa. 1888
J. B. Rozier . . . . . Memphis, Tenn. 1887
Dr. Thomas P. Russell . . . . . Oshkosh, Wis. 1888
Dr. R. Rutherford . . . . . Houston, Tex. 1879
D. E. Salmon, D. V. M. . . . . Washington, D. C. 1883
Dr. Lucien F. Salomon . . . . . New Orleans, La. 1879
Prof. J. Leonard Sanford . . . . . New Haven, Conn. 1885
Prof. D. A. Sargent . . . . . Cambridge, Mass. 1883
Dr. Wilbur T. Sarles . . . . . Sparta, Wis. 1888
Dr. Adolf F. Saurehering . . . . . Mayville, Wis. 1888
Dr. D. D. Saunders . . . . . Memphis, Tenn. 1879
Dr. N. J. Sawyier . . . . . Frankfort, Ky. 1879
Dr. Edward W. Schauffler, 1221 Washington St. Kansas City, Mo. 1891
Dr. W. L. Schenck . . . . . Topeka, Kan. 1891
Dr. W. S. Scott . . . . . Dickson, Tenn. 1891
Dr. John H. Sears . . . . . Waco, Tex. 1887
Dr. Nicholas Senn . . . . . Chicago, Ill. 1888
Dr. J. C. Shapard . . . . . Winchester, Tenn. 1891
Dr. Joseph Sharp, 1027 Cherry St. . . . . Kansas City, Mo. 1891
Dr. Charles H. Shepard, 81 Columbia Heights . . Brooklyn, N. Y. 1889
Dr. J. L. Shepard . . . . . Sheboygan Falls, Wis. 1888
Dr. George R. Shepherd . . . . . Hartford, Conn. 1886
Dr. George W. Sheppard . . . . . Atlantic City, N. J. 1889
Dr. B. Franklin Sherman . . . . . Ogdensburg, N. Y. 1887
Dr. John J. Sherman . . . . . Marinette, Wis. 1888
Dr. William H. Shipps . . . . . Bordentown, N. J. 1889
Dr. John C. Shrader . . . . . Iowa City, Iowa. 1890
Dr. John D. Shull . . . . . Hightstown, N. J. 1888
Dr. F. L. Simm . . . . . Memphis, Tenn. 1885
Dr. T. Grange Simons . . . . . Charleston, S. C. 1881
Dr. James Simpson . . . . . San Francisco, Cal. 1886
Dr. Maxwell G. Simpson . . . . . Jersey City, N. J. 1889
Dr. C. M. Sitman . . . . . Greensburg, La. 1878
Dr. Charles Smart, U. S. A. . . . . Washington, D. C. 1882
Samuel M. Smedley, C. E. . . . . Philadelphia, Pa. 1874
Dr. Charles D. Smith . . . . . Portland, Me. 1885
Dr. David S. Smith, 1255 Michigan Ave. . . . . Chicago, Ill. 1880

Dr. Hugh M. Smith, 78 Orange St. . . . . Brooklyn, N. Y. 1889
Dr. Joel W. Smith . . . . . Charles City, Ia. 1888
Dr. Joseph R. Smith, U. S. A. . . . . Los Angeles, Cal. 1874
Roland H. Smith, M. E. . . . . Pittsburg, Pa. 1887
Rev. Samuel G. Smith, D. D. . . . . St. Paul, Minn. 1889
Dr. Stephen Smith, 574 Madison Ave. . . . . New York City. 1872
Dr. Theobald Smith . . . . . Washington, D. C. 1888
Gen. W. J. Smith . . . . . Memphis, Tenn. 1878
Dr. William M. Smith, 91 First Pl. . . . . Brooklyn, N. Y. 1880
Dr. Whitmore Sniverly . . . . . Pittsburg, Pa. 1873
Frank H. Snow . . . . . Lawrence, Kan. 1891
Dr. Andrew B. Somers . . . . . Omaha, Neb. 1888
Dr. S. B. Sperry . . . . . Delafield, Wis. 1888
Dr. Joseph Spiegelhalter, 2166 Lafayette Ave. . . St. Louis, Mo. 1880
Prof. J. M. Stalker, D. V. S. . . . . Ames, Iowa. 1890
Dr. Grant Francisco Starkey, V. S. . . . . Boone, Iowa. 1891
Dr. Byron Stanton . . . . . Cincinnati, Ohio. 1889
Dr. Franklin Staples . . . . . Winona, Minn. 1885
Dr. Ralph E. Starkweather . . . . . Springfield, Ill. 1879
Dr. Lewis H. Steiner . . . . . Baltimore, Md. 1872
Surgeon-General George M. Sternberg, U. S. A. Washington, D. C. 1874
Dr. James A. Steuart . . . . . Baltimore, Md. 1874
Dr. Eugene F. Storke . . . . . Milwaukee, Wis. 1888
Dr. Charles Sutherland, U. S. A., ... Washington, D. C. 1889
Dr. W. R. D. Sutherland . . . . . Winnipeg, Manitoba. 1886
Dr. R. M. Swearingen . . . . . Austin, Tex. 1880
E. F. Swinney . . . . . Kansas City, Mo. 1891
Dr. Alexander N. Talley . . . . . Columbia, S. C. 1890
Dr. R. P. Talley . . . . . Belton, Tex. 1880
Albert B. Tavel, Esq. . . . . Nashville, Tenn. 1879
Dr. Knut Martin Olson Teigen, 341 9th Ave. S. . Fargo, N. Dak. 1891
Dr. A. P. Tenney, 540 Minnesota Ave. . . . . Kansas City, Mo. 1891
Dr. J. P. Thomas . . . . . Pembroke City, Ky. 1889
M. Louise Thomas, 680 Lexington Ave. . . . . New York City. 1888
Dr. Theodore G. Thomas . . . . . New York City. 1888
Dr. Pinckney Thompson . . . . . Henderson, Ky. 1879
Dr. Sidney Thompson . . . . . Kerrville, Tenn. 1887
Dr. G. B. Thornton . . . . . Memphis, Tenn. 1879
Dr. A. D. R. Thrane . . . . . Eau Claire, Wis. 1889
J. L. Tobias . . . . . Charleston, S. C. 1890
Dr. Joseph M. Toner . . . . . Washington, D. C. 1872
Dr. Edwin C. Town, 309 N. 37th St. . . . . Philadelphia, Pa. 1888
Dr. Smith Townshend . . . . . Washington, D. C. 1879
Dr. Roger S. Tracy, 67 W. 37th St. . . . . New York City. 1889
Dr. Thomas J. Turner, U. S. N. . . . . Coldwater, Mich. 1877
Dr. Gerrard G. Tyrrell . . . . . Sacramento, Cal. 1885
Dr. W. C. Van Bibber . . . . . Baltimore, Md. 1875
Dr. Joshua M. Van Cott, Jr., 188 Henry St. . . . Brooklyn, N. Y. 1889

Dr. J. H. Van Deman . . . . . Chattanooga, Tenn. 1873
Dr. F. P. Vandenbergh . . . . . Buffalo, N. Y. 1888
Dr. E. V. Van Norman . . . . . San Diego, Cal. 1882
Dr. B. A. Vaughan . . . . . Columbus, Miss. 1882
Dr. E. E. Vaughan . . . . . Cambridge, Mass. 1887
Dr. Victor C. Vaughan . . . . . Ann Arbor, Mich. 1883
Prof. Frank Preston Venable . . . . . Chapel Hill, N. C. 1890
Dr. W. W. Vinnedge . . . . . Lafayette, Ind. 1882
Dr. Leopoldo Viramontes, No. O Nacional St.
Chilpancingo, Guerrero, Mex. 1891
Dr. John H. Vivian . . . . . Mineral Point, Wis. 1888
Dr. E. P. Vollum, U. S. A., Broadway . . . . . New York City. 1889
Dr. Karl Von Ruck . . . . . Asheville, N. C. 1890
Dr. F. L. Von Suessmilch . . . . . Delevan, Wis. 1889
Dr. A. P. Waddell . . . . . Union City, Tenn. 1891
Dr. Henry P. Walcott . . . . . Cambridge, Mass. 1880
Dr. Charles Finlay Waldron Oklahoma City, Oklahoma Territory. 1891
Dr. Jerome Walker, 8 Seventh Ave. . . . . Brooklyn, N. Y. 1889
Dr. T. P. C. Walker . . . . . Dyersburg, Tenn. 1891
Dr. John P. Wall . . . . . Tampa, Fla. 1875
Dr. D. A. Wallace . . . . . Terrell, Tex. 1889
Dr. David L. Wallace . . . . . Newark, N. J. 1885
Shippen Wallace, Ph. D. . . . . Burlington, N. J. 1885
Dr. Ralph Walsh . . . . . Washington, D. C. 1885
L. B. Ward, C. E. . . . . Jersey City, N. J. 1885
Dr. Horace Wardner . . . . . La Porte, Ind. 1877
Col. George E. Waring, C. E. . . . . Newport, R. I. 1875
Dr. R. P. Waring, 1010 Grand Ave. . . . . Kansas City, Mo. 1891
Dr. Irving A. Watson . . . . . Concord, N. H. 1881
Dr. J. Madison Watson . . . . . Elizabeth, N. J. 1882
Dr. R. D. Webb . . . . . Birmingham, Ala. 1878
Albert L. Webster, C. E., 107 Drexel Building . . New York City. 1885
Dr. John O. Webster . . . . . Augusta, Me. 1889
Dr. Warren Webster, U. S. A. . . . . Wells River, Vt. 1873
Dr. Henry M. Wells, U. S. N. . . . . Washington, D. C. 1889
Dr. Joseph M. Wells . . . . . Camden, N. J. 1887
Dr. H. P. Wenzel . . . . . Milwaukee, Wis. 1888
Hon. James A. Weston . . . . . Manchester, N. H. 1890
Dr. William C. Wey . . . . . Elmira, N. Y. 1872
Alfred T. White, 40 Remsen St. . . . . Brooklyn, N. Y. 1889
William A. White, 158 Columbia Heights . . . Brooklyn, N. Y. 1889
Dr. C. P. Wilkinson . . . . . New Orleans, La. 1889
Dr. J. Louis Williamson . . . . . Milwaukee, Wis. 1888
Dr. H. L. Williford . . . . . Memphis, Tenn. 1891
Dr. G. H. Wilson, 50 Colony St. . . . . Meriden, Conn. 1890
Dr. A. E. Winchell . . . . . New Haven, Conn. 1886
Dr. Uranus Owen Brackett Wingate, 204 Biddle St., Milwaukee, Wis. 1890
Elisha Winter, 179 Quincy St. . . . . Brooklyn, N. Y. 1879

Dr. Simeon P. Wise . . . . . Millersburg, Ohio. 1886
Dr. G. F. Witter . . . . . Grand Rapids, Mich. 1877
Prof. Edward S. Wood . . . . . Boston, Mass. 1876
Dr. A. A. Woodhull, U. S. A. . . . . Hot Springs, Ark. 1874
Dr. Nathaniel Eugene Wordin, 174 Fairfield Ave. Bridgeport, Conn. 1890
William E. Worthen, C. E., 63 Bleeker St. . . . New York City. 1872
Dr. A. R. Wright . . . . . Buffalo, N. Y. 1881
Dr. Franklin W. Wright . . . . . New Haven, Conn. 1889
Dr. John Wright . . . . . Sardis, Miss. 1879
Dr. James Henry Wroth . . . . . Albuquerque, New Mexico. 1891
Dr. Benjamin Franklin Wyman . . . . . Aiken, S. C. 1890
Dr. Walter Wyman, Super.Surgeon-General, U. S. M. H. S. . . . . Washington, D. C. 1884
Dr. W. M. Yandell . . . . . El Paso, Texas. 1891
Dr. A. G. Young . . . . . Augusta, Me. 1885
Dr. Francis J. Young . . . . . Bridgeport, Conn. 1887
Andrew Young . . . . . Chicago, Ill. 1884
John Preston Young . . . . . Memphis, Tenn. 1888

ASSOCIATE MEMBERS.

William Gravel, 788 Broadway . . . . . New York. 1890
Alexander L. Patrick . . . . . Detroit, Mich. 1889
Rev. Joseph Wild, D. D. . . . . Toronto, Ont. 1886

HONORARY MEMBERS.

President Grover Cleveland . . . . . New York City. 1885
Dr. J. B. Russell, LL. D. . . . . Glasgow, Scotland. 1886
Mrs. Elizabeth Thompson . . . . . New York City. 1887
President Porfirio Diaz . . . . . Mexico, Mex. 1892

LIFE MEMBER.

Henry Lomb . . . . . Rochester, N. Y. 1884

LIST OF MEMBERS ELECTED AT THE TWENTIETH ANNUAL MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, HELD AT THE CITY OF MEXICO, NOVEMBER AND DECEMBER, 1892.

ACTIVE.

Dr. Enrique L. Abogado . . . Plaza de San Juan 17, Mexico, Mex.
Dr. A. Aceves . . . . . Guadalajara, Jalisco, Mex.
Dr. Julio Castillo y Adalid . . San Juan de Letrán 9, Mexico, Mex.
Dr. Ignacio Aguado . . . . . Toluca, Mex.
Dr. Manuel C. Aguilar . . . . . Zacatecas, Zacatecas, Mex.
Dr. J. Aguilar . . . . . Hermosillo, Sonora, Mex.
Dr. Juan P. Aguilar . . . . . Merida, Yucatan, Mex.
Dr. Alberto Aizpuru . . . . . Mexico, Mex.
Dr. Rafael Aizpuru . . . . . Mexico, Mex.
Dr. Luis G. Alcantara . . . . Irapuato, Guanajuato, Mex.
Dr. Edward Alexander . . . . . El Paso, Tex.
Dr. Jose Alfaro . . . . . Vera Cruz, Vera Cruz, Mex.
Dr. L. Alfaro . . . . . Mexico, Mex.
Dr. Antonio F. Alonso . . . . . Mexico, Mex.
Dr. Fernando Altamira . . . . . Mexico, Mex.
Dr. Fernando Altamirano . . . . Guadalupe, Fed. Dis., Mex.
Dr. F. Alvarez . . . . . Mexico, Mex.
Dr. Francisco Alvarez . . . . . Oaxaca, Oaxaca, Mex.
Dr. Tostado Teofilo Alvarez . . . . Guadalajara, Jalisco, Mex.
Dr. Manuel de Anaya . . . . Guanajuato, Guanajuato, Mex.
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Dr. R. Andrade . . . . . Merida, Yucatan, Mex.
Dr. F. Araujo . . . . . Mexico, Mex.
Dr. E. Armendariz . . . . . Mexico, Mex.
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Dr. Tom C. V. Barkley . . . 600 Market St., Chattanooga, Tenn.
Dr. Manuel Barreiro . . . . . Mexico, Mex.
Mr. William P. Baum . . . . . Roup St., Pittsburgh, Penn.
Dr. Jose Baviera . . . . . Durango, Durango, Mex.
Sr. Carlos Bello . . . . . Puebla, Puebla, Mex.
Dr. Francisco Bello . . . . . Puebla, Puebla, Mex.
Dr. M. Benitez . . . . . Guadalajara, Jalisco, Mex.
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Dr. Francisco Bernaldez . . . . . Mexico, Mex.
Dr. Daniel B. Blake, Health Officer city of Cuero and DeWitt county . . . . . Cuero, Tex.
Dr. F. Blasquez . . . . . Mexico, Mex.
Dr. Joaquin Blengio . . . . . Campeche, Campeche, Mex.
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Dr. John Robinson Buist . . . 151 N. Spruce St., Nashville, Tenn.
Dr. Charles Jenkins Burroughs, Health Officer Jacksonville . . . . . 119 W. Church St., Jacksonville, Fla.
Dr. Fletcher A. Butler . . . . . Harvard, Neb.
Dr. George D. Butler, Health Officer Pulaski and Giles county . . . . . Pulaski, Tenn.
Dr. Antonio Butron . . . . . Acapulco, Guerrero, Mex.
Dr. Juan Cabell oy Siller . . . . Saltillo, Coahuila, Mex.
Dr. E. Cacho . . . . . Mexico, Mex.
Dr. Juan Calderon . . . . . Puebla, Puebla, Mex.
Dr. Jose Maria Calderon . . . . . Puebla, Puebla, Mex.
Dr. Frank Hawkins Caldwell, Pres. Orange county Board of Health . . . . . Sanford, Fla.
Dr. A. L. del Campo, ... Lagos, Jalisco, Mex.
Sr. Manuel Galban Campos . . . . . Mexico, Mex.
Dr. Juan M. Campos . . . . . Toluca, Mex.
Dr. R. Cañedo . . . . . Apizaco, Tlaxcala, Mex.
Mr. George Turner Cann . . . . 116 Bryan St., Savannah, Ga.
Dr. Alcacio Donaciano y Cano . . . . . Mexico, Mex.

Dr. Rafael Caraza . . . . . Mexico, Mex.
Dr. Antonio J. Carbajal . . . . . Mexico, Mex.
Dr. Santa Maria Carlos . . . . . Durango, Durango, Mex.
Dr. Bonifacio Carmona . . . . . Queretaro, Queretaro, Mex.
Dr. Manuel Carmona y Valle . . . . . Mexico, Mex.
Dr. James G. Carpenter . . . . . Stanford, Ky.
Dr. J. A. Carranza . . . . . Morelia, Michoacan, Mex.
Dr. Enrique Carrera . . . . . Mexico, Mex.
Dr. A. Carrillo . . . . . Nuevo Leon, Monterey, Mex.
Dr. Filiberto Carriles . . Aguascalientes, Aguascalientes, Mex.
Dr. Gabriel J. Casillas . . . . . Puebla, Puebla, Mex.
Dr. Tomas Casillas . . . . . Guanajuato, Guanajuato, Mex.
Dr. Adolfo Castañares . . . . . Tabasco, Tabasco, Mex.
Dr. Alfonso Castillo . . . . . Toluca, Mex.
Dr. Ramon Castillo . . . . . Oaxaca, Oaxaca, Mex.
Dr. Lucas Castro . . . . . Mexico, Mex.
Dr. S. Cervantes . . . . . Mexico, Mex.
Dr. Agustin Chacon . . . . . Mexico, Mex.
Dr. Carlos Chaix . . . . . Toluca, Mex.
Dr. T. Chavez Ignacio . . . . . Mexico, Mex.
Dr. Lorenzo Chavez . . . . . Mexico, Mex.
Dr. Tomas Chavez . . . . . Guanajuato, Guanajuato, Mex.
Dr. Liceaga Jesus Chico . . . . Guanajuato, Guanajuato, Mex.
Dr. George W. Christian, Health Officer, Burnet county . Burnet, Tex.
Dr. Frank H. Clarke, Physician and Med. Supt. East'n Ky. Insane Asylum . . . . . Lexington, Ky.
Dr. William C. Cole . . . . . Attica, Ind.
Dr. Buenrostro Juan y Collantes . . . . . Mexico, Mex.
Dr. Milton H. Collins, Health Officer . . . So. Charleston, O.
Dr. George Walter Copeland . . . . Middleborough, Mass.
Dr. Leartus Connor, Editor *American Lancet*, 103 Cass St., Detroit, Mich.
Dr. Angel Contreras . . . . . Puebla, Puebla, Mex.
Dr. Diodoro Contreras . . . . Vera Cruz, Vera Cruz, Mex.
Dr. M. Cordero . . . . . Mexico, Mex.
Dr. William T. Corlett . . . . 333 Prospect St., Cleveland, O.
Dr. Aaron Cornish . . . . 155 William St., New Bedford, Mass.
Dr. A. Coronado . . . . . Mexico, Mex.
Dr. N. Coronado . . . . . Ixtlan, Terr. Tepic, Mex.
Dr. Antonio J. Correa . . . . . Mexico, Mex.
Dr. Delgado J. Correa . . . . . Zacatecas, Zacatecas, Mex.
Dr. Federico Cota . . . . . La Paz, Baja Cal., Mex.
Dr. Milton P. Creel, Health Officer, Mahlenberg county, Central City, Ky.
Dr. Colonel Thomas Dahlen . . . . . Dundee, Ill.
Dr. A. A. Dance . . . . . Hamilton, Bermuda.
Dr. G. Davila . . . . . Puebla, Puebla, Mex.
Dr. Richard H. Day, Member La. State Board of Health, 214 5th St., Baton Rouge, La.
Dr. Simon P. Deahofe . . . 191 High St., Mineral Point, Wis.
Dr. Barriga Placido Diaz . . . . . Puebla, Puebla, Mex.
Dr. Barriga Rafael Diaz . . . . . Mexico, Mex.

Dr. Gonzalez Jose de Jesus Diaz . . . . Puebla, Puebla, Mex.
Dr. Jesus Diaz de Leon . . . . . Aguascalientes, Mex.
Dr. Lozano J. Diaz . . . . . Cuantitlan, Mex.
Dr. John Norman Dixon . . . 6th and Monroe Sts., Springfield, Ill.
Dr. Horace Oscar Dodge, Prof. Physical Diagnosis and Hygiene, University of Colorado . . . . . Boulder, Col.
Dr. Manuel Dominguez . . . . . Mexico, Mex.
Dr. George Henry Donahue . . . . . Northport, R. I.
Dr. Richard Douglass, Prof. Med. Dept. Vanderbilt Uni. Nashville, Tenn.
Dr. Oliver M. Doyle . . . . . Seneca, So. Carolina.
Dr. G. W. Drake, City Board Health . . Walnut St., Chattanooga, Tenn.
Dr. Burwell Alexander Duncan, Chief Health Officer West Point and Clay county . . . . West Point, Miss.
Dr. James A. Duncan . . . . . 1107 Broadway, Toledo, O.
Dr. John A. Dunwoody, Health Officer 200½ Newcastle St., Brunswick, Ga.
Sr. Jose Duvallon . . . . . Mexico, Mex.
Dr. Benjamin Franklin Eads . . . . . Marshall, Tex.
Dr. Charles Richard Earley . . . . . Ridgway, Penn.
Mr. H. C. Eccles . . . . . Charlotte, N. C.
Dr. J. Antonio de Echavarri . . . . . Mexico, Mex.
Dr. Wallace E. Edgerton, Sec. county Board of Health . Salem, S. D.
Dr. Ricardo Egea . . . . . Mexico, Mex.
Dr. Gregorio Encinas . . . . . Puebla, Puebla, Mex.
Dr. Juan Enriguez . . . . . Chihuahua, Mex.
Dr. Herbert D. Ensign . . . . . Boone, Iowa.
Dr. Alberto Escobar . . . . . Mexico, Mex.
Dr. Manuel de Esesarte . . . . . Oaxaca, Oaxaca, Mex.
Dr. F. Espinola . . . . . Tepic, Terr. Tepic, Mex.
Dr. Alberto Espinosa . . . . . Pachuca, Hidalgo, Mex.
Dr. Bravo Ernesto Espinosa . . . . . Puebla, Puebla, Mex.
Dr. Roman Estrada . . . . . Tenancingo, Mex.
Dr. Philo Judson Farnsworth, Prof. in State Uni. of Iowa, 332 So. Ave., Clinton, Iowa.
Dr. Ignacio Farquet . . . . . Puebla, Puebla, Mex.
Dr. Henry Marshall Fenno . . 77 West Main St., Rochester, N. Y.
Dr. F. Ferguson, Bacteriologist Board of Health, 20 W. 38th St., New York City.
Dr. Trinidad J. Ferrer . . . . . Mexico, Mex.
Dr. Ernesto Pablo Fichtner . . . . . Mexico, Mex.
Dr. Priscitiano Figueroa . . . . . Guaymas, Sonora, Mex.
Dr. William M. Findley . . . . . Altoona, Penn.
Dr. Francis W. Firmin . . . . . Findlay, O.
Dr. C. I. Fletcher . . . . . Indianapolis, Ind.
Dr. Alvarez Manuel Flores . . . . Guadalajara, Jalisco, Mex.
Dr. Joseph M. Fort . . . . Austin and High Sts., Paris, Tex.
Dr. Manuel de la Fuente . . . . . Teziultan, Puebla, Mex.
Dr. Albert Fulton . . . . 2353 S. Broadway, St. Louis, Mo.
Sr. Jose Gamboa . . . . . Mexico, Mex.
Dr. Adrian de Garay . . . . . Mexico, Mex.
Sr. Francisco de Garay . . . . . Mexico, Mex.
Dr. A. Pedro Garcia . . . . . Jalapa, Vera Cruz, Mex.

Dr. Crescencio Garcia . . . . . Cotija, Michoacan, Mex.
Dr. Fuentes Dionisio Garcia . . . . . Saltillo, Coahuila, Mex.
Dr. Lozano Ignacio Garcia . . S. Luis Potosi, S. Luis Potosi, Mex.
Dr. M. Garcia . . . . . Mapimi, Chihuahua, Mex.
Dr. Peña Manuel Garcia . . . . . Vera Cruz, Vera Cruz, Mex.
Sr. Sanchez Facio Rafael Garcia . . . . . Mexico, Mex.
Dr. Salvador Garciadiego . . . . . Guadalajara, Jalisco, Mex.
Dr. Adrian Garduño . . . . . Mexico, Mex.
Dr. Cantu Rafael Garza . . . . Monterey, Nuevo Leon, Mex.
Dr. Cardenas Luis de la Garza . . . Chihuahua, Chihuahua, Mex.
Dr. Francisco de la Garza . . . . . Mexico, Mex.
Dr. A. S. Gates . . . . . Franklin, La.
Dr. Angel Gaviño . . . . . Mexico, Mex.
Dr. J. P. Gayon . . . . . Mexico, Mex.
Dr. A. Gazano . . . . . Mexico, Mex.
Dr. Luman Moody Giffin, Prof. in Med. Dept. University of Colorado . . . . . Boulder, Col.
Dr. M. Godoy . . . . . Mexico, Mex.
Dr. Benito Gomez . . . . . Queretaro, Queretaro, Mex.
Dr. Eugenio Z. Gomez . . . . . Colima, Mex.
Dr. Gutierrez F. Gomez . . Sta. Maria del Oro, Terr. Tepic, Mex.
Dr. José Gomez . . . . . Mexico, Mex.
Dr. Juan B. Gomez . . . . . Cuantitlan, Mex.
Dr. Amezcua J. Gonzalez . . . . S. Luis, S. Luis Potosi, Mex.
Dr. Luis G. Gonzalez . . . . . Zacatecas, Zacatecas, Mex.
Dr. M. M. Gonzalez . . . . . Morelia, Michoacan, Mex.
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Dr. Visiero Francisco y Guerrero . . . . . Mexico, Mex.
Dr. Pedro Guevara . . . . . Queratarо, Queratarо, Mex.
Dr. F. Gutierrez . . . . . Mexico, Mex.
Dr. Nuño Emigdio Gutierrez . . . . Guadalajara, Jalisco, Mex.
Dr. Ignacio Guzman . . . . . Toluca, Mex.
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Dr. Alfred George Heaney . . . . . Corpus Christi, Tex.
Dr. Francisco Hernandez . . . . Oaxaca, Oaxaca, Mex.
Dr. J. Hernandez . . . . . Progeso, Yucatan, Mex.
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Dr. Garcia Francisco Lopez . . . . Merida, Yucatan, Mex.
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